ORDER NO. MTC9801736C1
B1

Service Manual

Color Television

Main Manual
(NA6L/M)

Panasonic

Models	Chassis
CT-20G33W	ANEDP301
CT-20G23W	AEDP301
CT-20G23DW	APEDP301
CT-20G13W	AMEDP301
CT-20G13DW	AREDP301
CT-20R15W	ADP302
CT-20R15CW	ADP302

This Service Manual is issued as a service guide for the models of the NA6L family listed above. Included in this manual are a set of schematics, block diagrams, operations overview, functional descriptions, alignment procedures, disassembly procedures, and a complete parts list.

"**WARNING!** This Service Manual is designed for experienced repair technicians only and is not designed for use by the general public. It does not contain warnings or cautions to advise non-technical individuals of potential dangers in attempting to service a product. **Products powered by electricity should be serviced or repaired only by experienced professional technicians.** Any attempt to service or repair the product or products dealt with in this Service Manual by anyone else could result in serious injury or death."

The service technician is required to read and follow the "**Safety Precautions**" and "**Important Safety Notice**" in this manual.

Panasonic ®

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Important Safety Notice

Special components are used in this television set which are important for safety. These parts are identified on the schematic diagram by the symbol ⚠ and printed in **BOLD TYPE** on the replacement parts list. It is essential that these critical parts are replaced with the manufacturer's specified replacement parts to prevent X-ray radiation, shock, fire or other hazards. Do not modify the original design without the manufacturer's permission.

Safety Precautions

General Guidelines

An **Isolation Transformer** should always be used during the servicing of a receiver whose chassis is not isolated from the AC power line. Use a transformer of adequate power rating as this protects the technician from accidents resulting in personal injury from electrical shocks. It will also protect the Receiver from being damaged by accidental shorting that may occur during servicing.

When servicing, observe the original lead dress, especially in the high voltage circuit. Replace all damaged parts (also parts that show signs of overheating.)

Always Replace Protective Devices, such as fishpaper, isolation resistors and capacitors, and shields after servicing the Receiver. Use only manufacturer's recommended rating for fuses, circuit breakers, etc.

High potentials are present when this Receiver is operating. Operation of the Receiver without the rear cover introduces danger from electrical shock. Servicing should not be performed by anyone who is not thoroughly familiar with the necessary precautions when servicing high-voltage equipment.

Extreme care should be practiced when **Handling the Picture Tube**. Rough handling may cause it to implode due to atmospheric pressure (14.7 lbs per sq. in.). Do not nick or scratch the glass or subject it to any undue pressure. When handling, use safety goggles and heavy gloves for protection. **Discharge the picture tube** by shorting the anode to chassis ground (not to the cabinet or to other mounting hardware). When discharging, connect cold ground (i.e. dag ground lead) to the anode with a well insulated wire or use a grounding probe.

Avoid prolonged exposure at close range to unshielded areas of the picture tube to prevent exposure to X-ray radiation.

The **Test Picture Tube** used for servicing the chassis at the bench should incorporate safety glass and magnetic shielding. The safety glass provides shielding for the tube viewing area against X-ray radiation as well as implosion. The magnetic shield limits X-ray radiation around the bell of the picture tube in addition to restricting magnetic effects. When using a picture tube test jig for service, ensure that the jig is capable of handling 35.5kV without causing X-ray radiation.

Before returning a serviced receiver to the owner, the service technician must thoroughly test the unit to ensure that it is completely safe to operate. **Do not use a line isolation transformer when testing.**

Leakage Current Cold Check

Unplug the AC cord and connect a jumper between the two plug prongs.

Measure the resistance between the jumpered AC plug and exposed metallic parts such as screwheads, antenna terminals, control shafts, etc. If the exposed metallic part has a return path to the chassis, the reading should be between 240kΩ and 5.2MΩ. If the exposed metallic part does not have a return path to the chassis, the reading should be infinite.

Leakage Current Hot Check (See Figure 1)

Plug the AC cord directly into the AC outlet. Do not use an isolation transformer during the check.

Connect a 1.5kΩ 10 watt resistor in parallel with a 0.15μF capacitor between an exposed metallic part and ground. Use earth ground, for example a water pipe.

Using a DVM with a 1000 ohms/volt sensitivity or higher, measure the AC potential across the resistor.

Repeat the procedure and measure the voltage present with all other exposed metallic parts.

Verify that any potential does not exceed 0.75 volt RMS. A leakage current tester (such as a Simpson Model 229, Sencore Model PR57 or equivalent) may be used in the above procedure, in which case any current measure must not exceed 1/2 milliamp. If any measurement is out of the specified limits, there is a possibility of a shock hazard and the Receiver must be repaired and rechecked before it is returned to the customer.

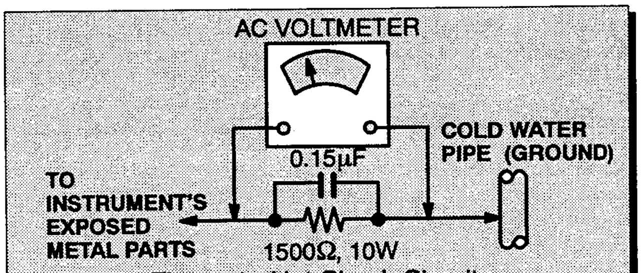

Figure 1. Hot Check Circuit

X-ray Radiation

WARNING: The potential source of X-ray radiation in TV sets is in the High Voltage section and the picture tube.

NOTE: It is important to use an accurate, calibrated high voltage meter.

Set the **brightness, picture, sharpness** and **color** controls to Minimum.

Measure the High Voltage. The high voltage meter should indicate 27.7kV ±1.25kV. If the upper limit is out of tolerance, immediate service and correction is required to insure safe operation and to prevent the possibility of premature component failure.

Horizontal Oscillator Disable Circuit Test

This test must be performed as a final check before the Receiver is returned to the customer. See **Horizontal Oscillator Disable Circuit Procedure Check** in this manual.

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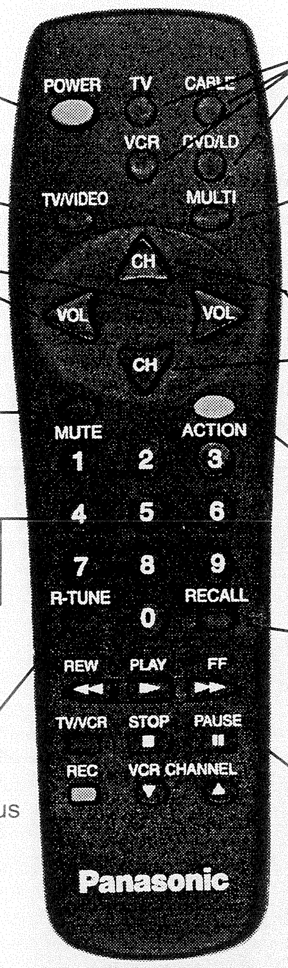
SPECIFICATIONS

Receiver Feature Table

FEATURE\MODEL	CT-20G33W	CT-20G23W/DW	CT-20G13W/DW	CT-20R15W/CW
Chassis	NA6LM	NA6LM	NA6LM	NA6LM
# of channels / Tuning	181 / 40K	181 / 40K	181 / 40K	181 / 40K
Menu language	ENG/SPAN/FR	ENG/SPAN/FR	ENG/SPAN/FR	ENG/SPAN/FR
Closed Caption	YES	YES	YES	YES
75 Ω input	YES	YES	YES	YES
Remote Model #	EUR511112	EUR511112	EUR501371	EUR501371
CRT	A51KQN011X	A51KQN011X	A51KQN011X	A51KRE89XDT
Notch filter	YES	YES	YES	YES
V/A norm (X=both)	Video	Video	Video	Video
MTS/SAP/DBX	MTS	MTS	MTS	NO
Built-in audio power	1.5W / 16 ohm	1.5W / 16 ohm	1.5W / 16 ohm	1.5W /16 ohn
# of speakers	2	2	2	1
AI sound	YES	YES	NO	NO
A/V in (rear/front)	1/0	1/1	1/1	1/1
Variable audio out	YES	YES	NO	NO
Fixed audio out	YES	YES	NO	NO
Dimensions (WxHxD) mm in	516 x 462 x 492 20.31 x 18.19 x 19.37	516 x 462 x 492 20.31 x 18.19 x 19.3	516 x 462 x 492 20.31 x 18.19 x 19.3	510 x 467 x 476 20.07 x 18.39 x 18.74
Weight (kg/lb)	19.6 / 8.9	19.6 / 8.9	19.6 / 8.9	19.7 / 9.0
Power soruce (V / Hz)	120 / 60	120 / 60	120 / 60	120 / 60
Power consumption, Max (A)	1.4	1.4	1.4	1.3
Anode voltage	27.7kV ± 1.25kV	27.7kV ± 1.25kV	27.7kV ± 1.25kV	27.7kV ± 1.25kV
Video input jack	$1V_{p-p}$ 75Ω, phono jack	$1V_{p-p}$ 75Ω, phono jack	$1V_{p-p}$ 75Ω, phono jack	$1V_{p-p}$ 75Ω, phono jack
Audio input jack	500mV RMS 47kΩ	500mV RMS 47kΩ	500mV RMS 47kΩ	500mV RMS 47kΩ
"A"-Board TNP2AH003	CB	CA, CJ	CC, CH	DF
"C"-Board TNP2AA005	AB	AB	AB	AD

Table 1. **Receiver Features**

Remote Control For
For CT-20G33W & CT-20G23DW


POWER
TV
CABLE
VCR
DVD/LD
TV/VIDEO
MULTI
CH
VOL
VOL
CH
MUTE
ACTION
1
2
3
4
5
6
7
8
9
R-TUNE
RECALL
0
REW
PLAY
FF
TV/VCR
STOP
PAUSE
REC
VCR CHANNEL
Panasonic

EUR511112

Power Button
Press to turn ON or OFF.

TV/Video Button
Press to select TV or Video Input.

Volume Buttons
Press to adjust TV sound level. Use with Channel buttons to navigate in menus.

Mute Button
Press to mute sound. A second press resumes sound. Press also to access and delete Closed Caption.

Keypad Buttons
Press desired channel number to randomly access any channel.

R-Tune (Rapid Tune) Button
Press to switch to the previous channel.

TV, CABLE, VCR, DVD/LD
Press to select remote operation

Multi Button
Programmable to operate up to six Remote Control Function buttons simultaneously.

Channel Buttons
Press to select channels. Use with Volume buttons to navigate in menus.

Action Button
Press to display Main Menu and access or exit On Screen feature and Adjustment Menus.

Recall Button
Press to display Time, status of Sleep Timer, Channel, Video Mode, Channel Caption (Station Identifier) and Audio Mode.

REW, PLAY, FF, TV/VCR, STOP, PAUSE, REC., VCR CHANNEL
Component function buttons

Remote Control For
For CT-20G13W/DW & CT-20R15W/CW

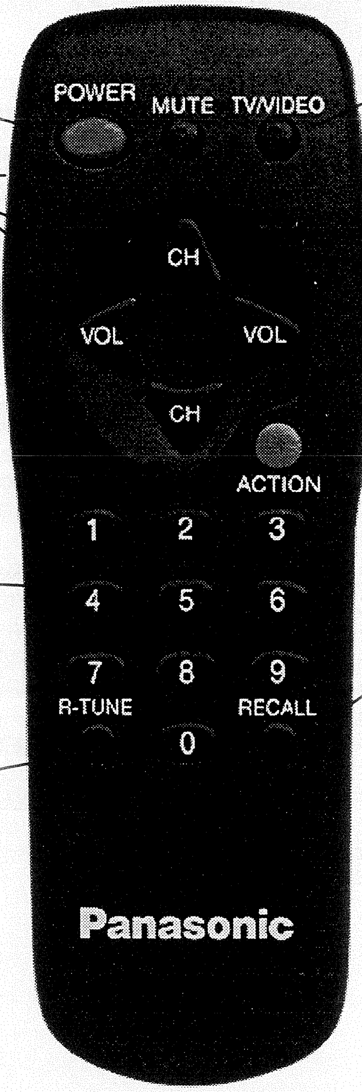
Power Button
Press to turn ON or OFF.

Mute Button
Press to mute sound. A second press resumes sound. Press also to access and delete Closed Caption.

Volume Buttons
Press to adjust TV sound level. Use with Channel buttons to navigate in menus.

Keypad Buttons
Press desired channel number to randomly access any channel.

R-Tune (Rapid Tune) Button
Press to switch to the previous channel.



EUR501371

TV/Video Button
Press to select TV or Video Input.

Channel Buttons
Press to select channels. Use with Volume buttons to navigate in menus.

Action Button
Press to display Main Menu and access or exit On Screen feature and Adjustment Menus.

Recall Button
Press to display Time, status of Sleep Timer, Channel, Video Mode, Channel Caption (Station Identifier) and Audio Mode.

Programming the Remote Control

The remote control can be set to control other manufacturers components, by utilizing the **MODE SELECTION BUTTONS** for **CABLE**, **DSS**, **VCR**, **RCVR** (a **Receiver** or **Amplifier**), **CD**, **LD**, and **AUX** (for **Cassette Deck, Second VCR** or a **DVD**.)

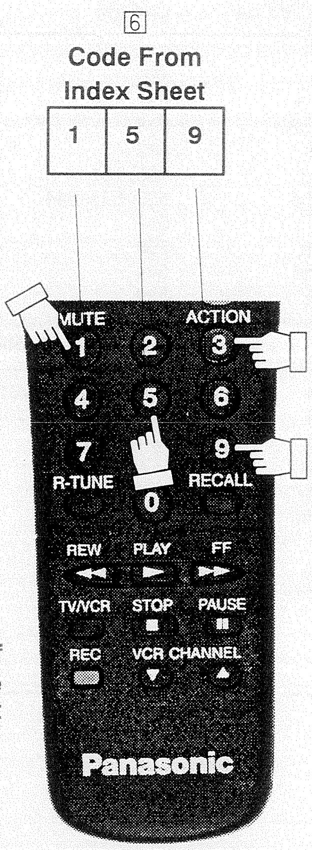
Code Known

Use the following procedure for setting up the remote control using the numerical buttons when the component's remote code is known.

1. Determine the brand of the component.
2. Identify the code(s) associated with the brand from the infrared code index (see following pages). Record all possible codes.
3. Confirm that the component is plugged in and operating properly, then turn it OFF.
4. **Press and hold the ACTION button, then the POWER button so that both are pressed at the same time for at least 5 seconds.** Then let go of the buttons.
5. **Press the appropriate Mode button for the component.**
6. **Enter the 3-digit code, by using the Remote Control Keypad "0" through "9" buttons.**

   Now the remote is set for the entered code.
7. **Press the POWER button to test the remote. If the correct code is setup for the component (in step 6), the component will turn on.**

NOTE: Some brands have multiple codes. Repeat the procedure using another listed code until the component responds correctly.



EUR511112

Code Unknown

Use the following procedure for setting up the remote control when the component's remote access code is not known. This procedure uses the "sequence method".

1. Confirm that the component is plugged in and operating properly, then turn it OFF.
2. **Press and hold the ACTION button, then the POWER button so that both are pressed at the same time for at least 5 seconds.** Then let go of the buttons.
3. **Press the appropriate Mode button for the device.**
4. **Press the VOL button to step over to the next code.**
5. **Press the POWER button to test the remote. If the correct code is sent, the component will turn on.**
6. **Once the correct code is found, press the ACTION button to store the code.**
7. Repeat from step 3 above until the proper component code is found. It may take several attempts before the correct code is found.

NOTE: If an incorrect code is entered, or when the operation is not completed within 30 seconds, the settings will not change.

OPERATION

Infrared Remote Codes for Specific Components

Helpful Hint: **Write down the code numbers for your components in the space provided below. This will serve as a handy reference whenever you need to reprogram your remote control.**

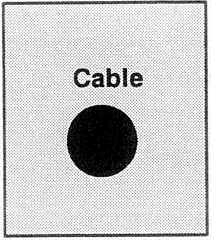
CABLE Cable TV Converter Box				**VCR** Video Cassette Recorder				**CD** Compact Disc Player			
DSS Digital Satellite System				**RCVR** Receiver or Amplifier				**LD** Laser Disc Player			
Other Component				Other Component				Other Component			
Other Component				Other Component				Other Component			

Cable Converter Box Infrared Codes Index

The Universal Infrared Remote Control is capable of operating many brands of Cable Converter Boxes and CD Players. Refer to the Programming the Remote Control section for procedures.

Note: The Universal Remote Control memory is limited; therefore, some models of Cable Converter Boxes and CD Players may not operate. The Universal Remote Control is not designed to control all features that are available in all models.

Note: After entering the proper infrared code, press the Remote **Cable** Selection Mode button. Then refer to the Remote Control Key Functions section, for Remote CBL function key listing.



Codes for Cable Converter Box

Brand of Cable–TV Box	Code(s)	Brand of Cable–TV Box	Code(s)
ABC	530	Philips	006, 007, 540, 541, 542, 535
Archer	531, 544	Pioneer	001, 260
Cableview	544	Pulsar	544
Citizen	522	Puser	544
Curtis	130, 131	RCA	121
Diamond	530, 531, 544	Realistic	544
Eagle	541	Regal	130, 350, 730, 731
Eastern	560	Regency	560
Gcbrand	544	Rembrandt	544
Gemini	522	Scientific Atlanta	122, 130, 131
General Instrument	122, 520, 521, 522, 523, 530, 531, 534, 704	Slmark	001
Hamlin	130, 350, 730, 731	Sprucer	121
Hitachi	003, 530	Stargate	544
Jerrold	534, 704	Sylvania	570
Macom	003	Teleview	001
Magnavox	535	Texscan	570
Memorex	542	Tocom	701, 704
Movietime	544	Unika	531, 544
Oak	704, 710	Universal	522, 544
Panasonic	121, 132	Videoway	006
		Viewstar	535, 541, 542
		Zenith	280

Laser Disc and DVD (Digital Videodisc) Infrared Codes Index

The Universal Infrared Remote Control is capable of operating selected brands of Laser Disc and DVD (Digital Videodisc). Refer to the Programming the Remote Control section for procedures.

Note: The Universal Remote Control memory is limited; therefore, some models of Laser Disc and DVD (Digital Videodisc) may not operate. The Universal Remote Control is not designed to control all features that are available in all models.

Note: After entering the proper infrared code, press the Remote **DVD/LD** Selection Mode button. Then refer to the Remote Control Key Functions section, for Remote Laser Disc function key listing.

Laser Disc Player

DVD/LD

●

Codes for Laser Disc

Brand of Laser Disc	Code(s)	Brand of Laser Disc	Code(s)
Denon	370	Quasar	100
Marantz	370	RCA	370
Mitsubishi	370	Sanyo	370
NEC	370	Sony	140
Panasonic	100	Teac	370
Pioneer	370	Toshiba	370
Proscan	370		

Digital Videodisc

DVD/LD

●

Codes for DVD (Digital Videodisc)

DVD	Code(s)	DVD	Code(s)
Denon	601	Saba	670
Ferguson	670	Sony	640
Nordmende	670	Thomson	670
Panasonic	601	Toshiba	500
Pioneer	870	Yamaha	601
RCA	670		

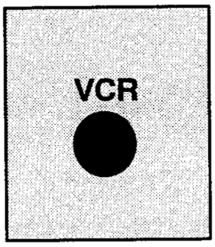
VCR Infrared Codes Index

The Universal Infrared Remote Control is capable of operating many brands of VCRs. Refer to the Programming the Remote Control section for procedures.

Note: The Universal Remote Control memory is limited; therefore, some models of VCRs may not operate. The Universal Remote Control is not designed to control all features that are available in all models.

Note: After entering the proper infrared code, press the Remote **VCR** Selection Mode button. Then refer to the Remote Control Key Functions chart, for Remote VCR function key listing.

OPERATION



Code Index for VCRs

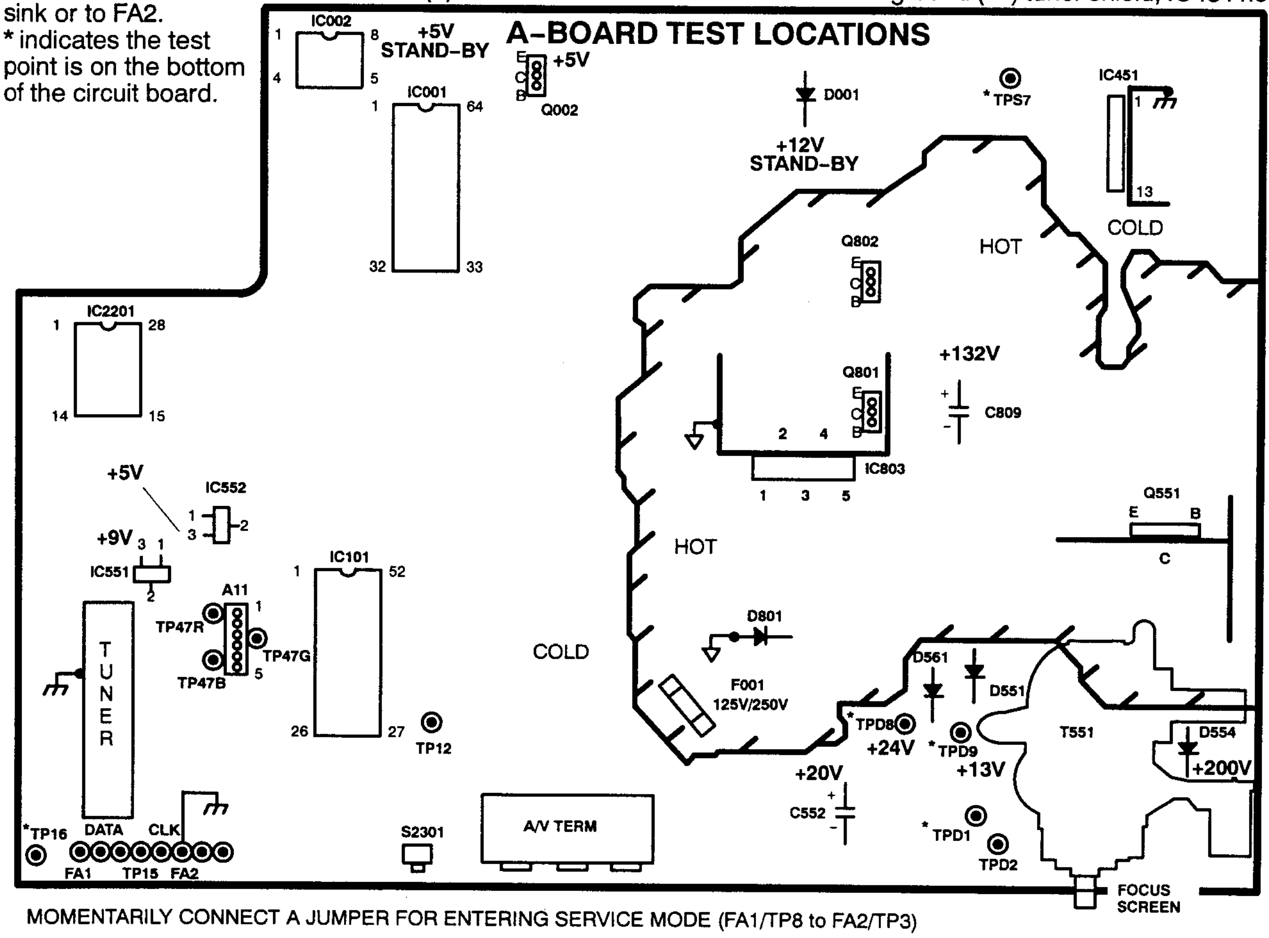
VCR Brand	Code(s)
Admiral	200
Aiwa	137
Akai	142
Audio Dynamic	011, 240
Bell & Howell	005
Broksonic	081, 136
Canon	135
Citizen	006
Craig	005, 006, 141
Curtis Mathes	130, 137
Daewoo	001, 130
DBX	011, 140
Emerson	003, 080, 081, 135, 136
Fisher	005, 007, 008, 009
Funai	081, 136, 137
GE	130, 170
Goldstar	006
Go Video	220
Hitachi	000
Instant Replay	130
Jensen	240
JVC	011, 190, 240
Kenwood	006, 011, 240
LXI	000, 005, 006, 007, 008, 009, 137
Magnavox	130, 150
Marantz	011, 240
Marta	006
Memorex	009, 130
MGA	230, 241
Minolta	000
Mitsubishi	230, 241
Multitech	137
NEC	011, 190, 240
Olympic	130
Optimus	006, 100, 200, 140
Orion	081, 136
Panasonic	100, 130
Penney	000, 005, 011, 130, 240
Pentax	000, 011
Philco	081, 130, 136, 137, 150
Philips	130, 150
Proscan	000, 001, 002,130, 150
Quasar	100, 130
Radio Shack	005, 009, 130, 137, 170, 210, 241
RCA	000, 001, 002, 130, 150, 170
Realistic	005, 009, 130, 137, 210, 241
Samsung	002, 220
Sansui	081, 136, 240
Sanyo	005, 009
Scott	001, 002, 009, 081, 136, 230, 241
Sears	000, 005, 006, 007, 008,
Sharp	200, 210
Signature 2000	137, 200
Sony	140, 141, 142
SV2000	137
Sylvania	130, 137, 150
Symphonic	137
Tashiro	006
Tatung	011, 240
Teac	011, 137, 240
Technics	100, 130
Teknika	130, 137
Toshiba	001
Vector Research	011
Wards	006, 009, 200, 210, 290
Yamaha	005, 011, 240
Zenith	290

Chassis Service Adjustment Procedures

All service adjustments are factory preset and should not require adjustments unless controls and/or associated components are replaced.

NOTE: Connect the (-) lead of the voltmeter to the appropriate ground for the circuit being checked. When necessary to use a line operated ground, the ground indication (⏚) is marked. For this ground use anode of D801 or IC803 heat sink. For all other circuits, connect the (-) lead of the voltmeter to the line isolated ground (⏚) tuner shield, IC451 heat sink or to FA2.

* indicates the test point is on the bottom of the circuit board.


A-BOARD TEST LOCATIONS
IC002
1
8
4
5
+5V
STAND-BY
+5V
Q002
IC001
1
64
32
33
D001
+12V
STAND-BY
*TPS7
IC451
1
13
COLD
HOT
Q802
Q801
+132V
C809
2
4
IC803
1
3
5
Q551
E
B
C
IC2201
1
28
14
15
+5V
IC552
1
2
3
+9V
3
1
IC551
2
A11
1
5
TP47R
TP47G
TP47B
IC101
1
52
26
27
TP12
TUNER
COLD
HOT
D801
F001
125V/250V
D561
D551
*TPD8
+24V
*TPD9
+13V
+20V
C552
T551
D554
+200V
*TPD1
TPD2
*TP16
DATA
CLK
FA1
TP15
FA2
S2301
A/V TERM
FOCUS
SCREEN

MOMENTARILY CONNECT A JUMPER FOR ENTERING SERVICE MODE (FA1/TP8 to FA2/TP3)

131.0V B+ Voltage Confirmation

1. Set the **Bright** and the **Picture** to Minimum by using the Picture Menu.
2. Connect a DVM between C809, + side and Hot ground (⏚).
3. Confirm that B+ voltage is 132.0V±2.5V. This voltage supplies B+ to the Horizontal Output & Flyback circuits.

Source Voltage Chart

120V AC line input. Set the **Bright** and the **Picture** to Minimum by using the Picture Menu. Use cold ground (⏚) for the (-) lead of the DVM.

IC551 pin 3	+9.0V ±0.5V
Cathode of D551 (TPD9)	+13.0V ±2V
C552 (+ side)	+20.0V ±2V
Cathode of D561 (TPD8)	+24.0V ±2V
Cathode of D554	+200V±15V

Adjust Picture menu for normalized video adjustments.

B+ 5V Source Voltages

Volatile 5V:

C572, + side = IC552 pin 3, Tuner BP, IC101 (B+ V_{CC}).

MPU 5V:

Emitter Q002 = IC001(V_{DD}).

Standby 5V:

IC001 (Key in 1), I^2C EEPROM (IC002), TIMER LED, Remote Receiver.

B+ 9V Source Voltage

IC551 pin 3 = IC101 (B+ V_{CC}), Tuner (BM).

B+ 12V (Stand-by) **Note: +16V when power is on**

Cathode D001 = RL801 (on-off relay), Q002 (+5V Reg).

High Voltage Check

1. Select an active TV channel and confirm that horizontal is in sync.
2. Adjust Brightness and Picture using Picture Icon menu so video just disappears.
3. Confirm B+ 132V is within limit.
4. Using a high voltage meter confirm that the High Voltage is 27.7kV ±1.25kV.

Purity and Convergence Procedure

Adjustment is necessary only if the CRT or the deflection yoke is replaced or if the setting was disturbed. The complete procedure consists of:

1. Initial static convergence.
2. Setting the purity.
3. Final static convergence.

When the CRT or the Yoke is Replaced

Place the yoke on the CRT neck (do not tighten the clamp).

For a 2–piece assembly (see Figure 2):

Position purity/convergence assembly as shown and tighten clamp snugly. Cut the hot–melt glue seal on assembly and place like tabs of purity device together at 12 o'clock to reduce its magnetic field effect. Manually degauss the CRT.

Turn the Receiver ON and slide the deflection yoke back and forth on the neck of the CRT. Stop at the position that produces a near white, uniform raster.

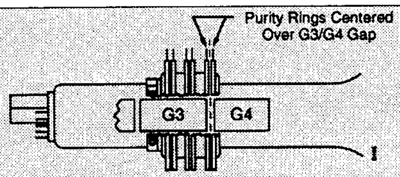


Figure 2. **Positioning of Purity/Convergence Assembly (2–piece assembly)**

For a 1–piece assembly (see Figure 3):

Place like tabs of purity devices together at 12 O'Clock to reduce any magnetic field effect. Manually degauss the set.

Connect a Black/White pattern generator and tune the receiver to the signal. Slide the deflection yoke & purity ring assembly back and forth on the CRT neck. Stop at a position that produces a near white signal.

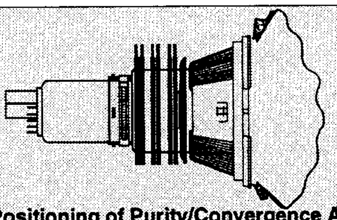


Figure 3. **Positioning of Purity/Convergence Assembly (1–piece assembly)**

Initial Center Static Convergence

Connect a dot/crosshatch generator to the Receiver and tune in signal. Observe misconvergence at center of the screen only.

Adjust the 4 pole magnet (center rings); separate tabs and rotate to converge blue with red.

Adjust the 6 pole magnet (rear rings): separate tabs and rotate to converge blue and red (magenta) with green. ***Note:*** *Precise convergence at this point is not important.*

Purity Adjustment

When the Receiver is in the Serviceman Mode for making electronic adjustments, press the **Recall** button on the Remote Control to enter Purity Check. (See **Service Adjustments Electronic Controls.**)

Operate the Receiver for 60 minutes using the first Purity check field (white screen) to stabilize the CRT.

Fully degauss the Receiver by using an external degaussing coil.

Press the **Recall** button on the Remote Control again until the Purity Check (green screen) appears.

For a 2–piece assembly (see Figure 2):

Loosen the deflection yoke clamp screw and move the deflection yoke back as close to the purity magnet as possible.

Adjust the purity rings to set the vertical green raster precisely at the center of the screen (see Figure 4).

NOTES:

1. CRT warm up with white screen (three guns activated) is needed to stabilize the shadow mask expansion.
2. Initial center static convergence (roughly centers three gun beams) is required in order to perform purity adjustment.

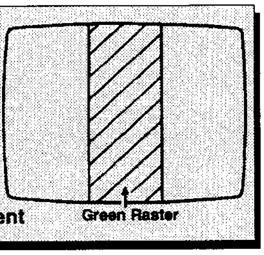


Figure 4. **Green Raster Adjustment**

Slowly move the deflection yoke forward until the best overall green screen is displayed.

For a 1–piece assembly (see Figure 3):

Slowly move the deflection yoke and purity rings assembly toward the CRT board and adjust the purity magnet rings to set vertical green raster at center of screen (see Figure 4).

Gradually move the deflection yoke & purity rings forward and adjust for the best overall green screen.

Continue from here for either assemblies:

Tighten the deflection yoke clamp screw.

Press the **Recall** button on the Remote Control again until the Purity Check (blue screen) and (red screen) appear and observe that good purity is obtained on each respective field.

Press the **Recall** button on the Remote Control again until Purity check (white screen) appears. Observe the screen for uniform white. If purity has not been achieved, repeat the above procedure.

Final Convergence Procedure (see Figure 5 through Figure 7):

Note: *Vertical size and focus adjustments must be completed prior to performing the convergence adjustment. Connect a dot pattern generator to the Receiver. The* ***Brightness*** *level should not be higher than necessary to obtain a clear pattern.*

Converge the red and blue dots at the center of the screen by rotating the 4 pole (R with B) Static Convergence Magnets.

Align the converged red/blue dots with the green dots at the center of the screen by rotating the 6 pole (R/B with G) Static Convergence Magnets. Melt wax with soldering iron to reseal the magnets.

Slightly tilt vertically and horizontally (do not rotate) the deflection yoke to obtain a good overall convergence.

If convergence is not reached at the edges, insert permalloy (see following section) from the DY corners to achieve proper convergence. Recheck for purity and readjust if necessary.

After vertical adjustment of the yoke, insert wedge at 6 o'clock position, then make the horizontal tilt adjustment.

Secure the deflection yoke by inserting two side wedges at 2 and 10 o'clock positions.

Apply adhesive between tab (thin portion) of wedge and CRT and place tape over the tab to secure to the CRT.

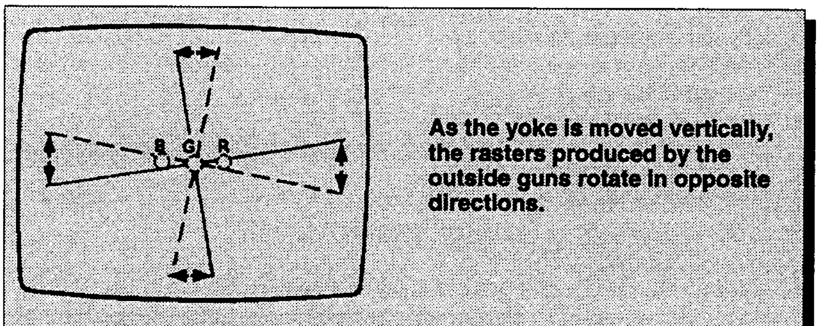
Permalloy Convergence Corrector Strip (Part No. OFMK014ZZ)

This strip is used in some sets to match the yoke and CRT for optimum convergence. If the yoke or CRT is replaced, the strip may not be required.

First converge the set without the strip and observe the corners.

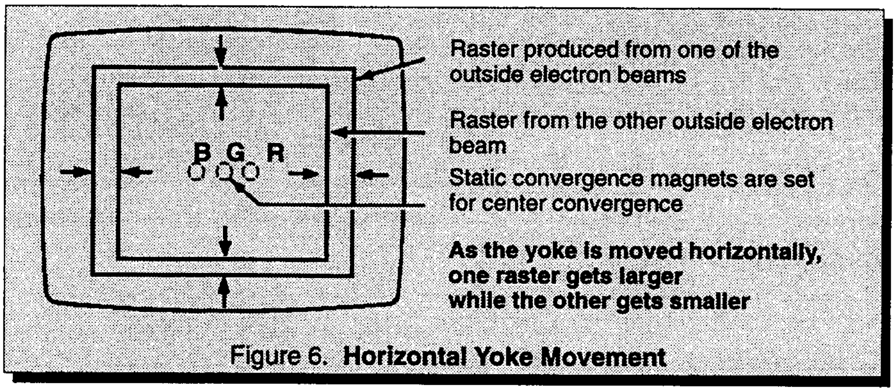
If correction is needed:

1. Place strip between CRT and yoke, in quadrant needing correction. Slowly move it around for desired results.
2. Press adhesive tightly to the CRT and secure with tape.



As the yoke is moved vertically, the rasters produced by the outside guns rotate in opposite directions.

Figure 5. **Vertical Yoke Movement**



Raster produced from one of the outside electron beams

Raster from the other outside electron beam

Static convergence magnets are set for center convergence

As the yoke is moved horizontally, one raster gets larger while the other gets smaller

Figure 6. **Horizontal Yoke Movement**

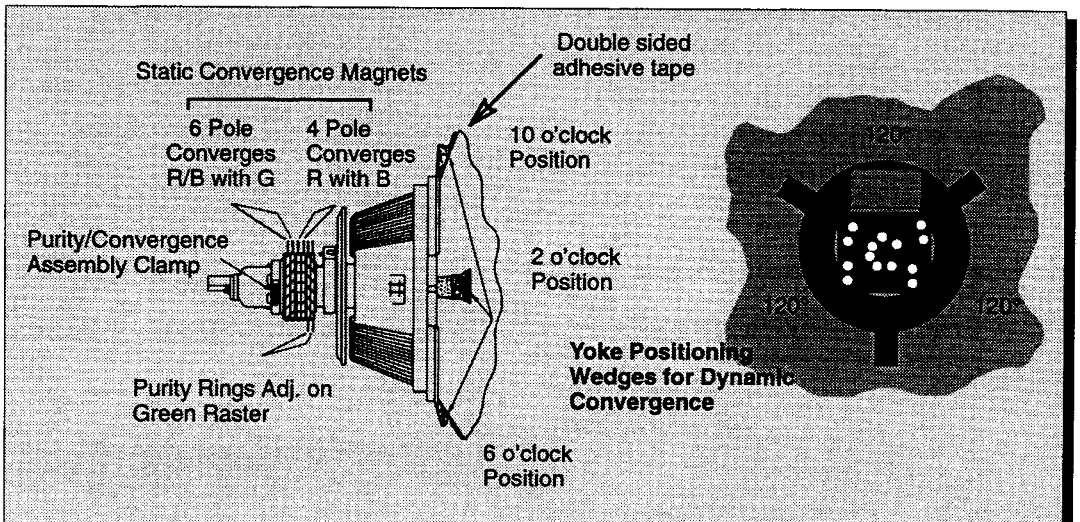

Static Convergence Magnets
6 Pole
Converges
R/B with G
4 Pole
Converges
R with B
Purity/Convergence
Assembly Clamp
Purity Rings Adj. on
Green Raster
Double sided
adhesive tape
10 o'clock
Position
2 o'clock
Position
6 o'clock
Position
120°
120°
120°
Yoke Positioning
Wedges for Dynamic
Convergence

Figure 7. **Convergence Magnets and Wedges Location**

Serviceman Mode (Electronic Controls)

This Receiver has electronic technology using the I^2C Bus Concept. It performs as a control function and it replaces many mechanical controls. Instead of adjusting mechanical controls individually, many of the control functions are now performed by using the "On Screen Display Menu". (The **Serviceman Adjustment Mode.**)

Note: *It is suggested that the technician reads all the way through and understand the following procedure for Entering/Exiting the **Serviceman Adjustment Mode**; then proceed with the instructions working with the Receiver. When becoming familiar with the procedure, the Flow Chart for Serviceman Mode may be used as a quick guide.*

Entering Serviceman Mode:

1. While the Receiver is ON and operating in Normal Mode, momentarily short test point FA1 to cold ground (⏚) FA2 (A–Board: TP pin 8 to pin 3).
   "The Receiver enters the Aging Mode".
   Yellow letters "CHK" appear in the upper left corner of the CRT.
   (The Volume Up/Down will adjust rapidly.)
2. Simultaneously **press** the **Action** and the **Volume Up** buttons on the Receiver Control Panel.
   "The Receiver enters the Serviceman's Mode".
   The letters in "CHK" turn red.
   (The Volume Up/Down will adjust normally.)
   (All customer controls are set to a nominal level.)
3. **Press** the **Power** button on the Remote Control to select one of five Serviceman Adjustment Modes.
   a. B = Serviceman VCJ SUB ADJUSTMENTS
   b. C = Serviceman VCJ CUT–OFF ADJUSTMENTS
   c. S = Serviceman OPTIONS (PIP and CLOCK) ADJUSTMENTS
   d. M = Serviceman MTS ADJUSTMENTS
   e. "CHK" = Normal operation of CHANNEL ▲▼ and VOLUME ◀ ▶

***Note:** Only the applicable settings for the Receiver serviced will be available (see a in Figure 8).*

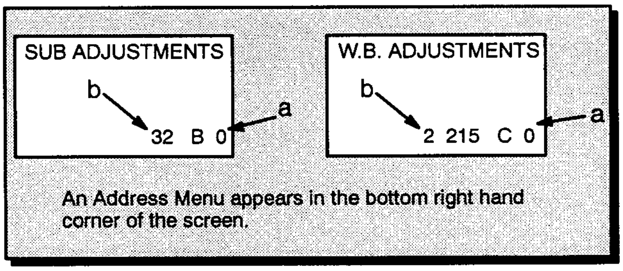

SUB ADJUSTMENTS
b
32 B 0
a
W.B. ADJUSTMENTS
b
2 215 C 0
a
An Address Menu appears in the bottom right hand corner of the screen.

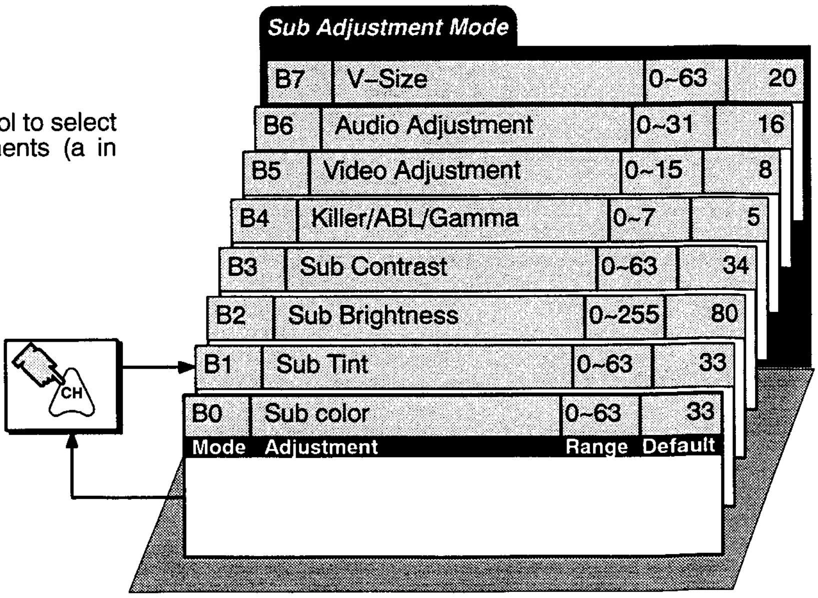
Figure 8. **Serviceman Mode Menu Adjustments**

For DAC Adjustments:

1. **Press**
   Channel Up/Down on the Remote Control to select one of the 8 available Service Adjustments (a in Figure 8).

   ***Important Note:** Write down the original value set (b in Figure 8) for each address before modifying anything. It is easy to erroneously adjust the wrong item.*

2. **Press**
   Volume Up/Down on the Remote Control to adjust the level of the selected Service Adjustment (b in Figure 8).



Mode	Adjustment	Range	Default
B7	V-Size	0~63	20
B6	Audio Adjustment	0~31	16
B5	Video Adjustment	0~15	8
B4	Killer/ABL/Gamma	0~7	5
B3	Sub Contrast	0~63	34
B2	Sub Brightness	0~255	80
B1	Sub Tint	0~63	33
B0	Sub color	0~63	33

Figure 9. **Sub Adjustment Mode**

Press the **Power** button on the Remote Control to select the Serviceman White Balance Adjustment Mode.

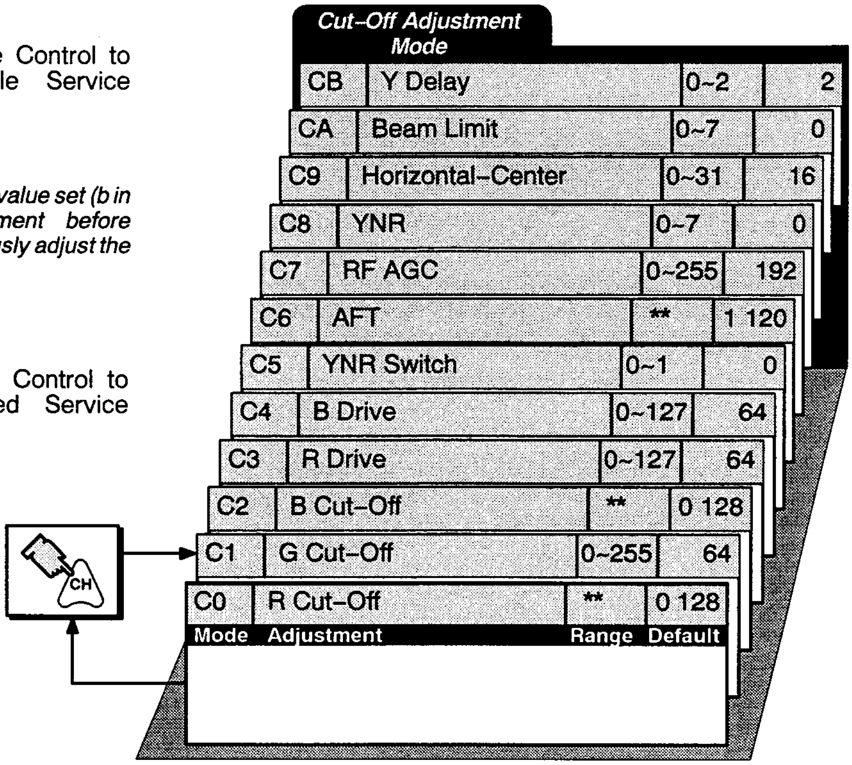
For VCJ Cut-Off Adjustments:

1. **Press**
   Channel Up/Down on the Remote Control to select one of the 12 available Service Adjustments (a in Figure 8).

   Important Note: *Write down the original value set (b in Figure 8) for each address adjustment before modifying anything. It is easy to erroneously adjust the wrong item.*

2. **Press**
   Volume Up/Down on the Remote Control to adjust the level of the selected Service Adjustment (b in Figure 8).

**** *Note:*** *Range is in steps:*
0 1 ~ 0 255
1 0 ~ 1 255



Cut-Off Adjustment Mode

Mode	Adjustment	Range	Default
CB	Y Delay	0~2	2
CA	Beam Limit	0~7	0
C9	Horizontal-Center	0~31	16
C8	YNR	0~7	0
C7	RF AGC	0~255	192
C6	AFT	**	1 120
C5	YNR Switch	0~1	0
C4	B Drive	0~127	64
C3	R Drive	0~127	64
C2	B Cut-Off	**	0 128
C1	G Cut-Off	0~255	64
C0	R Cut-Off	**	0 128

Figure 10. **White Balance Adjustment Mode**

Press the **Power** button on the Remote Control to select the Serviceman Options Adjustment Mode.

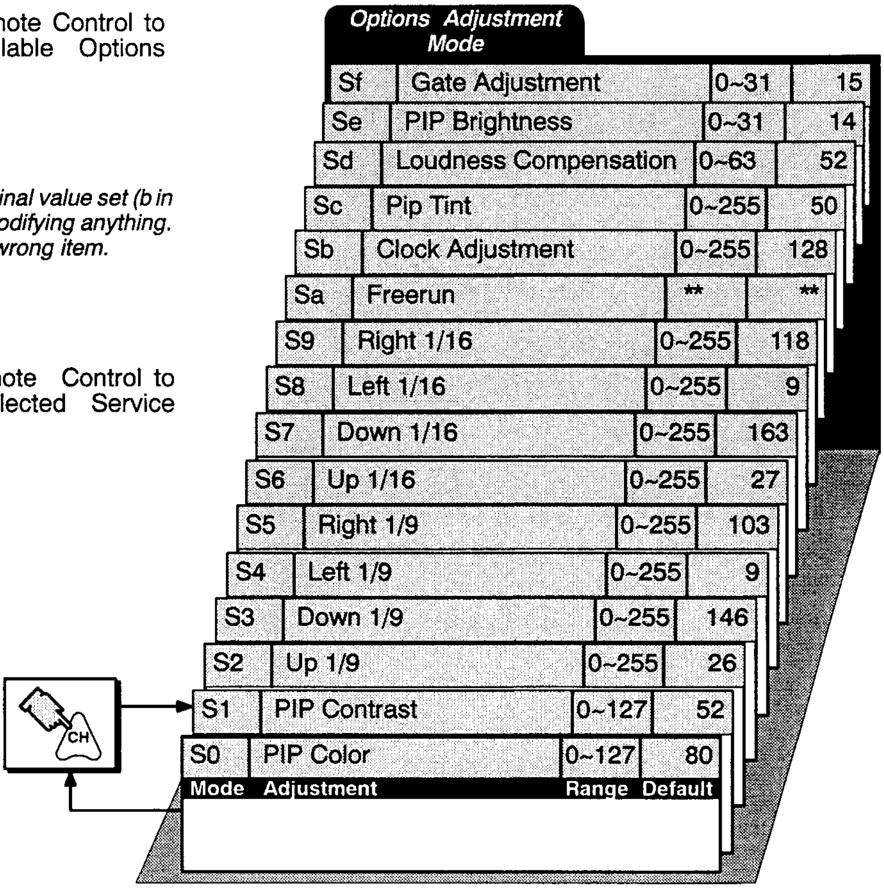
For Options (PIP and CLOCK) Adjustments:

1. **Press**
   Channel Up/Down on the Remote Control to select one of the 12 available Options Adjustments (a in Figure 8).

   Important Note: *Write down the original value set (b in Figure 8) for each address before modifying anything. It is easy to erroneously adjust the wrong item.*

2. **Press**
   Volume Up/Down on the Remote Control to adjust the level of the selected Service Adjustment (b in Figure 8).

*** Set Freerun on during this item selected.*



Mode	Adjustment	Range	Default
Sf	Gate Adjustment	0~31	15
Se	PIP Brightness	0~31	14
Sd	Loudness Compensation	0~63	52
Sc	Pip Tint	0~255	50
Sb	Clock Adjustment	0~255	128
Sa	Freerun	**	**
S9	Right 1/16	0~255	118
S8	Left 1/16	0~255	9
S7	Down 1/16	0~255	163
S6	Up 1/16	0~255	27
S5	Right 1/9	0~255	103
S4	Left 1/9	0~255	9
S3	Down 1/9	0~255	146
S2	Up 1/9	0~255	26
S1	PIP Contrast	0~127	52
S0	PIP Color	0~127	80

Figure 11. **Options Adjustment Mode**

Press the **Power** button on the Remote Control to select the Serviceman MTS Adjustment Mode.

For MTS Adjustments:

1. **Press**
   Channel Up/Down on the Remote Control to select one of the 5 available MTS Adjustments (a in Figure 8).

   Important Note: *Write down the original value set (b in Figure 8) for each address before modifying anything. It is easy to erroneously adjust the wrong item.*

2. **Press**
   Volume Up/Down on the Remote Control to adjust the level of the selected Service Adjustment (b in Figure 8).
3. Press the **POWER** button on the remote control to loop back to setting of the SUB ADJ Mode.

   OR

   Press **ACTION** and **POWER** buttons on the Receiver simultaneously for at least 2 seconds to return the Receiver to normal mode (exit Serviceman Mode).

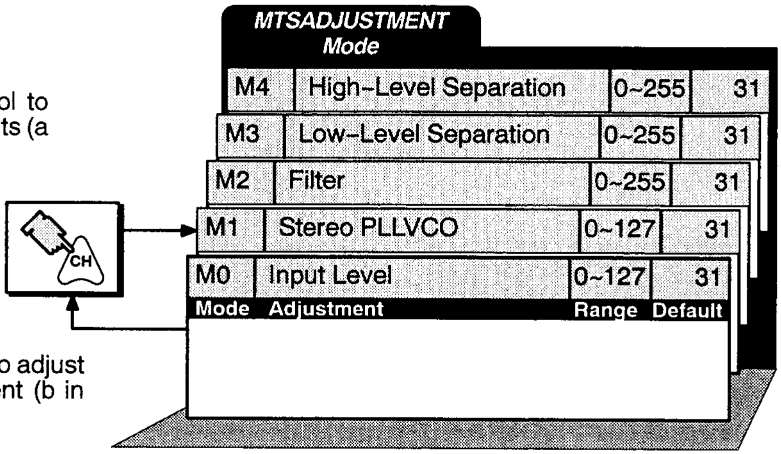

MTSADJUSTMENT Mode
M4 High-Level Separation 0~255 31
M3 Low-Level Separation 0~255 31
M2 Filter 0~255 31
M1 Stereo PLLVCO 0~127 31
M0 Input Level 0~127 31
Mode Adjustment Range Default
CH

Figure 12. **MTS Adjustment Mode**

To Check Purity:

Press the **Recall** button on the Remote Control when in Serviceman Modes (red "CHK" is displayed) to enter the Purity Field Check Mode.

Note: *The Receiver must be in the Serviceman Mode to display color.*

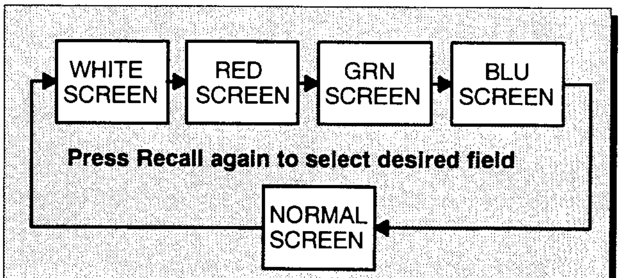

WHITE SCREEN
RED SCREEN
GRN SCREEN
BLU SCREEN
Press Recall again to select desired field
NORMAL SCREEN

Figure 13. **Purity Check Field Mode**

IMPORTANT NOTE:
Always Exit the Serviceman Mode following Adjustments.

Exiting the Serviceman Mode:

Press the **Action** and the **Power** buttons on the Receiver simultaneously for at least 2 seconds.

"The Receiver exits Serviceman Mode".

The Receiver momentarily shuts off; then comes back on tuned to channel 3 with a preset level of sound.

Helpful Hints

Quick Entry To Serviceman Mode:

At times when minor adjustments need to be done to the electronic controls, the method of Entering the Serviceman Mode without removal of the cabinet back is as follows using the Remote Control:

1. Select SET-UP icon and select CABLE mode.
2. Select TIMER Icon and set SLEEP timer for 30.
3. Press ACTION button twice to exit Menus.
   Tune to Channel 124.
   Adjust VOLUME to Minimum (0).
   On Receiver press the VOL ◀ button (decrease). Red "CHK" appears in upper corner.

To toggle between Aging and Serviceman modes:

While the "CHK" is displayed on the left top corner of the CRT, pressing the **Action** and the **Volume Down** buttons on the Receiver simultaneously will toggle between the modes.

Instructional Flow Chart for Serviceman Mode

Caution: Always EXIT Serviceman Mode

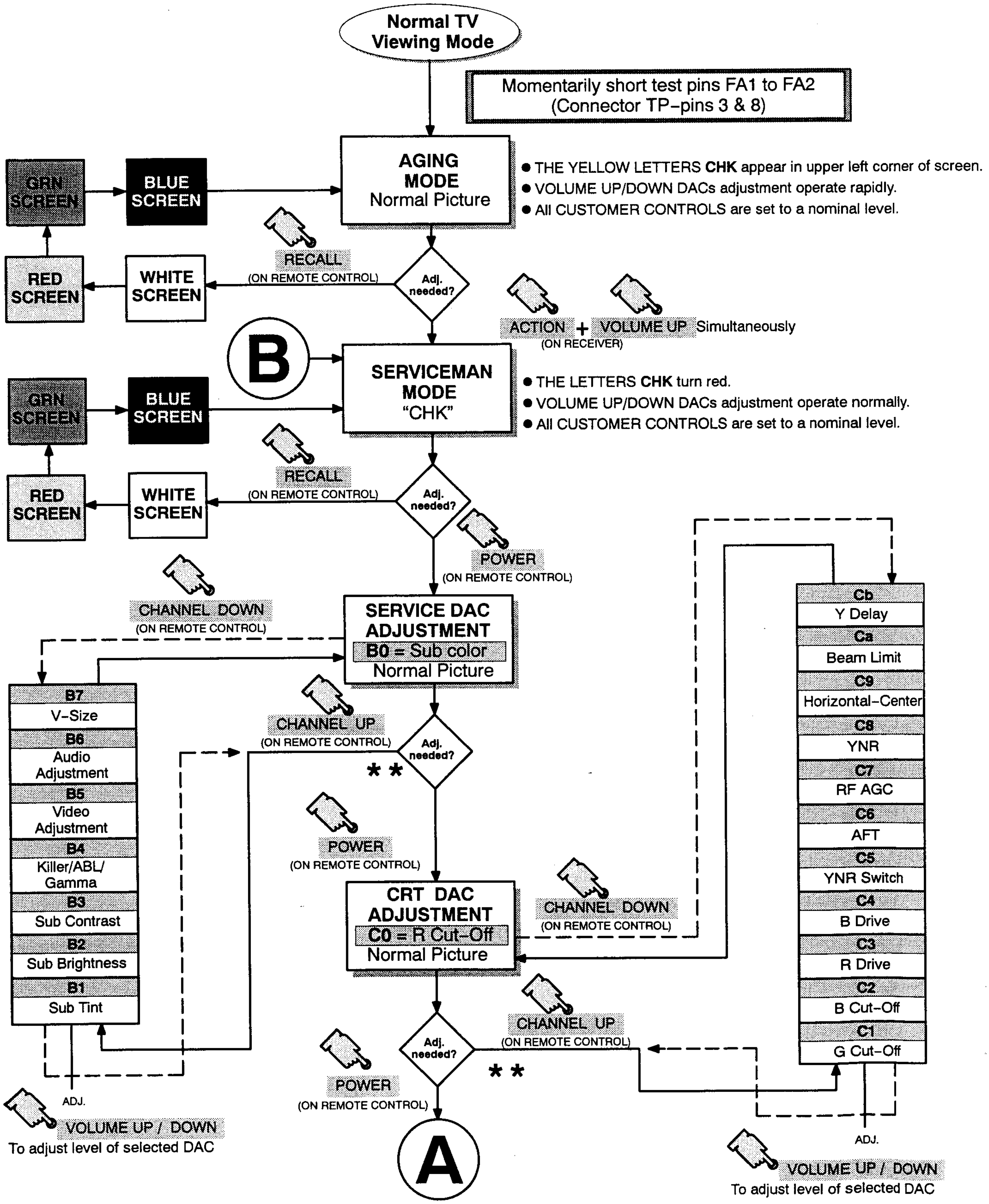

Normal TV
Viewing Mode
Momentarily short test pins FA1 to FA2
(Connector TP–pins 3 & 8)
AGING
MODE
Normal Picture
● THE YELLOW LETTERS CHK appear in upper left corner of screen.
● VOLUME UP/DOWN DACs adjustment operate rapidly.
● All CUSTOMER CONTROLS are set to a nominal level.
GRN
SCREEN
BLUE
SCREEN
RED
SCREEN
WHITE
SCREEN
RECALL
(ON REMOTE CONTROL)
Adj.
needed?
ACTION + VOLUME UP Simultaneously
(ON RECEIVER)
B
SERVICEMAN
MODE
"CHK"
● THE LETTERS CHK turn red.
● VOLUME UP/DOWN DACs adjustment operate normally.
● All CUSTOMER CONTROLS are set to a nominal level.
GRN
SCREEN
BLUE
SCREEN
RED
SCREEN
WHITE
SCREEN
RECALL
(ON REMOTE CONTROL)
Adj.
needed?
POWER
(ON REMOTE CONTROL)
CHANNEL DOWN
(ON REMOTE CONTROL)
SERVICE DAC
ADJUSTMENT
B0 = Sub color
Normal Picture
B7
V-Size
B6
Audio
Adjustment
B5
Video
Adjustment
B4
Killer/ABL/
Gamma
B3
Sub Contrast
B2
Sub Brightness
B1
Sub Tint
CHANNEL UP
(ON REMOTE CONTROL)
Adj.
needed?
* *
POWER
(ON REMOTE CONTROL)
CRT DAC
ADJUSTMENT
C0 = R Cut-Off
Normal Picture
CHANNEL DOWN
(ON REMOTE CONTROL)
Cb
Y Delay
Ca
Beam Limit
C9
Horizontal-Center
C8
YNR
C7
RF AGC
C6
AFT
C5
YNR Switch
C4
B Drive
C3
R Drive
C2
B Cut-Off
C1
G Cut-Off
CHANNEL UP
(ON REMOTE CONTROL)
Adj.
needed?
* *
POWER
(ON REMOTE CONTROL)
A
ADJ.
VOLUME UP / DOWN
To adjust level of selected DAC
ADJ.
VOLUME UP / DOWN
To adjust level of selected DAC

Figure 14. **Flow Chart for Serviceman Mode**

Instructional Flow Chart for Serviceman Mode – Continued

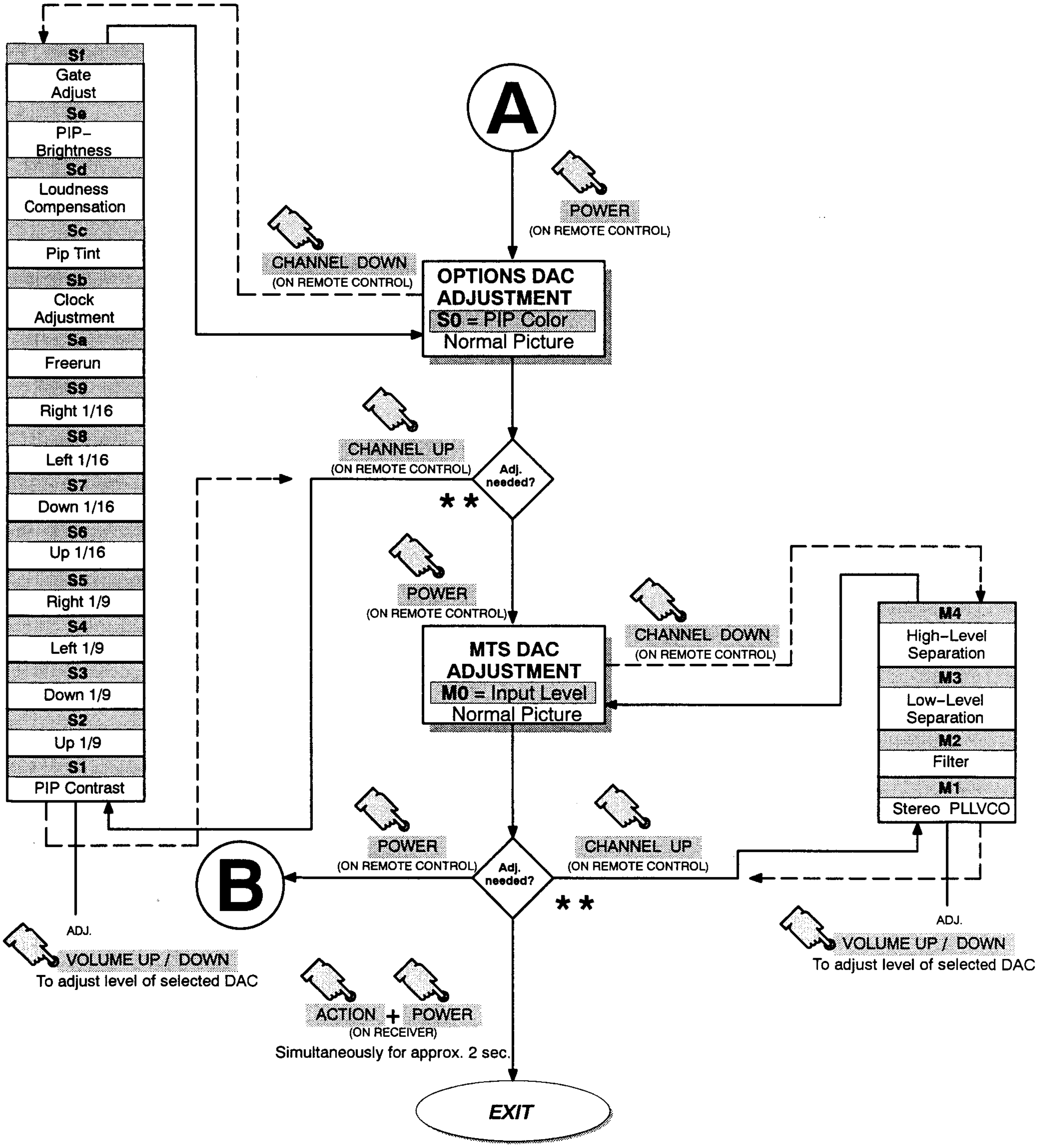

Sf
Gate Adjust
Se
PIP-Brightness
Sd
Loudness Compensation
Sc
Pip Tint
Sb
Clock Adjustment
Sa
Freerun
S9
Right 1/16
S8
Left 1/16
S7
Down 1/16
S6
Up 1/16
S5
Right 1/9
S4
Left 1/9
S3
Down 1/9
S2
Up 1/9
S1
PIP Contrast
A
POWER
(ON REMOTE CONTROL)
CHANNEL DOWN
(ON REMOTE CONTROL)
OPTIONS DAC ADJUSTMENT
S0 = PIP Color
Normal Picture
CHANNEL UP
(ON REMOTE CONTROL)
Adj. needed?
* *
POWER
(ON REMOTE CONTROL)
MTS DAC ADJUSTMENT
M0 = Input Level
Normal Picture
CHANNEL DOWN
(ON REMOTE CONTROL)
M4
High-Level Separation
M3
Low-Level Separation
M2
Filter
M1
Stereo PLLVCO
POWER
(ON REMOTE CONTROL)
CHANNEL UP
(ON REMOTE CONTROL)
Adj. needed?
* *
B
ADJ.
VOLUME UP / DOWN
To adjust level of selected DAC
ADJ.
VOLUME UP / DOWN
To adjust level of selected DAC
ACTION + POWER
(ON RECEIVER)
Simultaneously for approx. 2 sec.
EXIT

Figure 15. **Flow Chart for Serviceman Mode (Continued)**

Note: When *EXITING*, the Receiver shuts off; then turns on, TUNED TO CHANNEL 3 WITH A PRESET SOUND LEVEL.

Any Programmed Channels, Channels Caption data and some other user defined settings will be erased.

*** *Important Note***

Before making any DAC adjustments note the existing values!

Service Adjustments (Electronic Controls)

Sub–Brightness

Serviceman DAC Adjustment (B2)

Adjustment of this control is important for setting proper operation of customer brightness and picture controls. This adjustment must be made after Sub–Contrast or Color Temperature adjustments are made. **Do not adjust** SCREEN after the Sub–Brightness is set.

Preparation:

Apply a color bar signal with 100 IRE white and 7.5 IRE black. (Switch Color to "OFF" on the signal generator.) Operate the Receiver for a minimum of 10 minutes prior to performing this adjustment.

Procedure:

In the Serviceman Mode for making electronic adjustments, select the DAC adjustment (B2) and adjust until the black bar starts to look grey. Then decrease the level to the point where grey turns to black.

Video Adjustment Level

Serviceman DAC Adjustment (B5)

Preparation:

1. Obtain an NTSC color bar pattern with 100 IRE white and 87.5% modulation.
2. Connect the oscilloscope to TP12. Use cold ground for scope connection. Set the scope at Horizontal Sweep rate (20μs) time base.

Procedure:

1. In the Serviceman Mode for making electronic adjustments, select DAC Video Adjustment Level (B5) and adjust for 1V ±0.05V from sync tip to white level. See Figure 16.

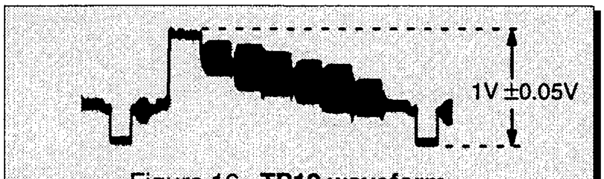


Figure 16. **TP12 waveform**

2. Set the DAC Sub–Contrast Adjustment (B3).

Sub–Contrast

Serviceman DAC Adjustment (B3)

This adjustment is factory set. **Do not adjust** unless repairs are made to associated circuit, the CRT Board or when the CRT is replaced.

Preparation:

1. Apply a color bar signal pattern with 87.5% modulation, 70% saturated color bar with a 100 IRE white and 7.5 black.

NOTE: The pattern used in this procedure is an EIA color bar pattern with 87.5% modulation with 100 IRE white and 7.5 black. Correlate the information in this procedure to the pattern used if another signal is used.

2. Connect the oscilloscope to the A–Board TP47G. Set the scope time base to 20μs (horizontal).
3. Connect a jumper from the high side of C560 to ground (TPD2, see chassis layout drawing).

Procedure:

1. In the Serviceman Mode for electronic adjustments, select DAC Sub–Contrast Adjustment (B3) and adjust for 2.8Vp–p ±0.1V from white level to black level on video waveform (see video waveforms detail, Figure 17).

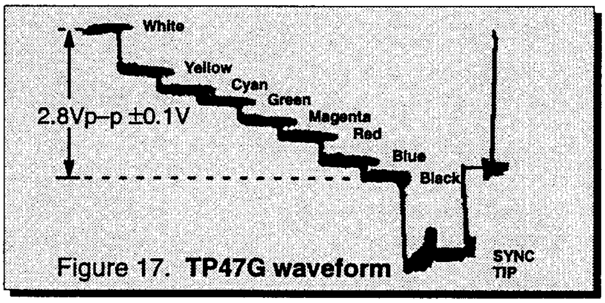


Figure 17. **TP47G waveform**

2. Remove the jumper (Preparation steps 3).

Tint/Color Adjustment

Serviceman DAC Adjustment (B1) (B0)

Preparation:

1. Apply a rainbow color bar signal.
2. Connect the oscilloscope to TP47B (A–Board).
3. Connect a jumper from the high side of C560 and GND (TPD2, see chassis layout drawing).

Procedure:

1. In the Serviceman Mode for making electronic adjustments, select DAC Sub–Tint Adjustment (B1). adjust until the waveform measured is as the one shown in Figure 18.

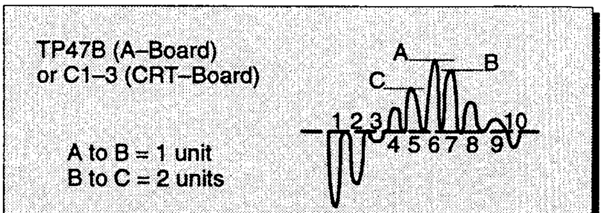


Figure 18. **TP47B waveform**

2. Connect the oscilloscope to TP47G (A–Board) or to connector C1 pin 2, TP35 (CRT–Board).
3. Select DAC Sub–Color Adjustment (B0) and adjust for peak to peak amplitude to be 0.75V p–p ±0.05V.

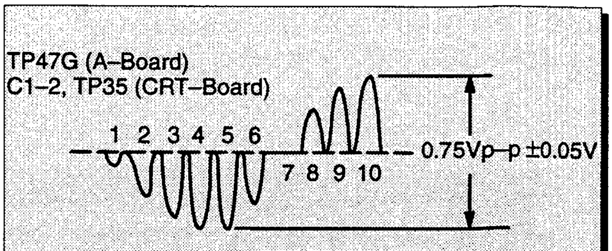


Figure 19. **TP47G waveform**

4. Remove the jumper (Preparation step 3).

Service Adjustments (Electronic Controls,cont.)

Color Temperature Adjustment (B/W Tracking)

Serviceman DAC Adjust. (C0) (C1) (C2) (C3) (C4)

Minor Touch-Up Method

OBSERVE low and high brightness areas of a B/W picture for proper tracking. Adjust only as required for "good grey scale and warm highlights".

1. LOW LIGHT areas - In Serviceman Mode for making electronic adjustments, select Cutoff (C0) RED, (C1) GRN, (C2) BLU and adjust the picture for grey.
2. HIGH LIGHT areas - In Serviceman Mode for making electronic adjustments, select Drive (C3) RED, (C4) BLU and adjust the picture for warm whites.

Complete Adjustment

Preparation:

1. Turn the Receiver "ON" and allow 10 minutes warm up at high brightness.
2. Apply a color bar signal with color "OFF".
3. Turn the SCREEN control (part of FBT T551) fully counterclockwise.

Procedure:

Preset Serviceman DACs C0, C1 and C2 levels to 128 for best results.

1. Connect the oscilloscope to TP47G.
2. In Serviceman Mode for making electronic adjustment, select the Sub-Bright DAC(B0).
3. Connect a jumper from TPS8 to FA2, (connector TP pin 6 to pin 3).
4. Observe the oscilloscope waveform at Horizontal rate and adjust the Serviceman Mode Sub-Bright DAC (B2) level until a scanning period of 2.4V above DC ground is measured, as indicated in Figure 20.

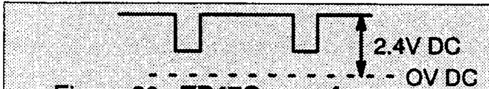


Figure 20. **TP47G waveform**

5. Remove the jumper. (Step 3)
6. Connect the scope to GRN Cathode (KG) on the CRT-Board.
7. In the Serviceman Mode for making electronic adjustments, select the GREEN CUTOFF DAC (C1).
8. Connect a jumper from TPS8 to FA2, (connector TP pin 6 to pin 3).
9. View scope trace at Horizontal rate and adjust the Serviceman Mode DAC (C1) level until a scanning period of 195V above DC ground is measured, as indicated in Figure 21.

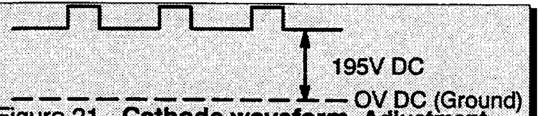


Figure 21. **Cathode waveform, Adjustment Waveform Detail (Steps 9, 14 & 19)**

10. Remove the jumper. (Step 8)
11. Connect the scope to the RED Cathode (KR).
12. In Serviceman Mode for making electronic adjustments, select the RED CUTOFF DAC (C0).
13. Connect a jumper from TPS8 to FA2, (connector TP pin 6 to pin 3).
14. View the scope trace and adjust the Serviceman Mode DAC (C0) for the scanning period to be 195V above DC ground. (See Figure 21)
15. Remove the jumper. (Step 13)
16. Connect the scope to the BLU Cathode (KB).
17. In Serviceman Mode for making electronic adjustments, select the BLU CUTOFF (C2).
18. Connect a jumper from TPS8 to FA2, (connector TP pin 6 to pin 3).
19. View the scope trace and adjust the Serviceman Mode DAC (C2) for the scanning period to be 195V above DC ground. (See Figure 21)
20. Turn the Screen Control (part of FBT) slowly clockwise until a color horizontal line appears.
21. With the other two colors Serviceman Mode DAC CUTOFF adjustments (C0) RED, (C1) GRN, (C2) BLU; increase the colors to create a white horizontal line.
22. Remove the jumper. (Step 18)
23. Confirm that a good gray scale is established by viewing B/W color bar pattern.
24 In the Serviceman Mode for making electronic adjustments select the DAC DRIVE adjustments (C3) RED, (C4) BLU and adjust for warm white in a white color bar pattern.
25. EXIT the Serviceman Mode.
26. Adjust the Picture Menu Video Adjustments **Bright** and **Picture** from low scale to high scale and check Black and White tracking.
27. If correction is needed: Re-Enter the Serviceman Mode and perform the **Minor Touch - Up Method.**
28. Perform **Sub-Brightness** Adjustment procedure.

Horizontal Centering

Serviceman DAC Adjustment (C9)

Preparation:

Connect a crosshatch generator.

Procedure:

1. In the Serviceman Mode for making electronic adjustments. Select the Horizontal Centering Adjustment DAC (C9) and adjust until the center of the crosshatch pattern is centered on CRT.
2. EXIT the Serviceman Adjustment Mode.

Audio Adjustment

Serviceman DAC Adjustment (B6)

This adjustment is factory set and needs to be performed only when IC002 or IC101 is replaced.

Preparation:

1. Apply the following signal at the antenna (70dB ±5dB, 75Ω open P/S 10dB): audio signal set to monaural, 300Hz. 100% modulation; video input of 100IRE flat field, 30% modulation.
2. Connect the RMS Meter with filter jig as shown in Figure 22.

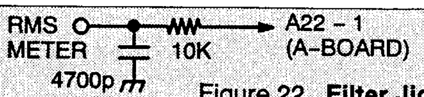


Figure 22. **Filter Jig**

Service Adjustments (Electronic Controls,cont.)

Procedure:

1. In the Serviceman Mode for making electronic adjustments, select the Audio Adjustment DAC (B6) and adjust until the RMS meter reading are: 150mV RMS ±7.5mV RMS
2. EXIT the Serviceman Adjustment Mode.

Clock Adjustment (Sb)

Preparation:

Connect the frequency counter from TPS1 (IC001 Pin 13) to cold ground (⏚).

NOTE: Frequency Counter probe capacitance should be 8pF or less.

Procedure:

1. Turn the Receiver "OFF" with the AC power applied.
2. Measure TPS1 (IC001 pin 13) for the frequency of the waveform and record the reading.

   Note: Pin 13 measurement must have at least four digits of resolution following the decimal point Example: 000.0000
3. Turn the Receiver back "ON".
4. Place the Receiver into Serviceman Mode for making electronic adjustment, select the Clock Adjustment DAC (Sb).
5. Calculate and set Sb based on the following formula:

$$Sb = 128 + 0.901 \times 10^6 \times \frac{\{244.1406 - \text{pin } 13\ [Hz]\}}{244.1406}$$

NOTE: Pin 13 measurement will not change regardless of the value stored in Sb.

Vertical Size (B7)

1. Adjust the VERTICAL SIZE DAC control, B7, until the top and the bottom edges of the raster are visible.
2. Adjust the VERTICAL SIZE control B7, until the top and the bottom of the raster touch the bezel edge. Then advance SIZE control to obtain an approximately 10% overscan. Linearity adjustment is done automatically when the size is being adjusted. (Best results can be obtained with a round test pattern.)

Service Adjustments (Mechanical Controls)

VCO Field Alignment L105

1. Connect a balance antenna and select a midband channel (Ch 10, 11 or 12)
2. Attenuate the signal strength for a weak noisy video.
3. While observing the picture tube, adjust L105 until best picture appears.
4. Change channels and observe that they are tuning properly.
5. If the channel monitored is not clear, repeat steps 1, 3 and 4 while applying a stronger signal.

Focus (Part of T551)

Preparation:

Connect a Signal generator and select a dot pattern.

Procedure:

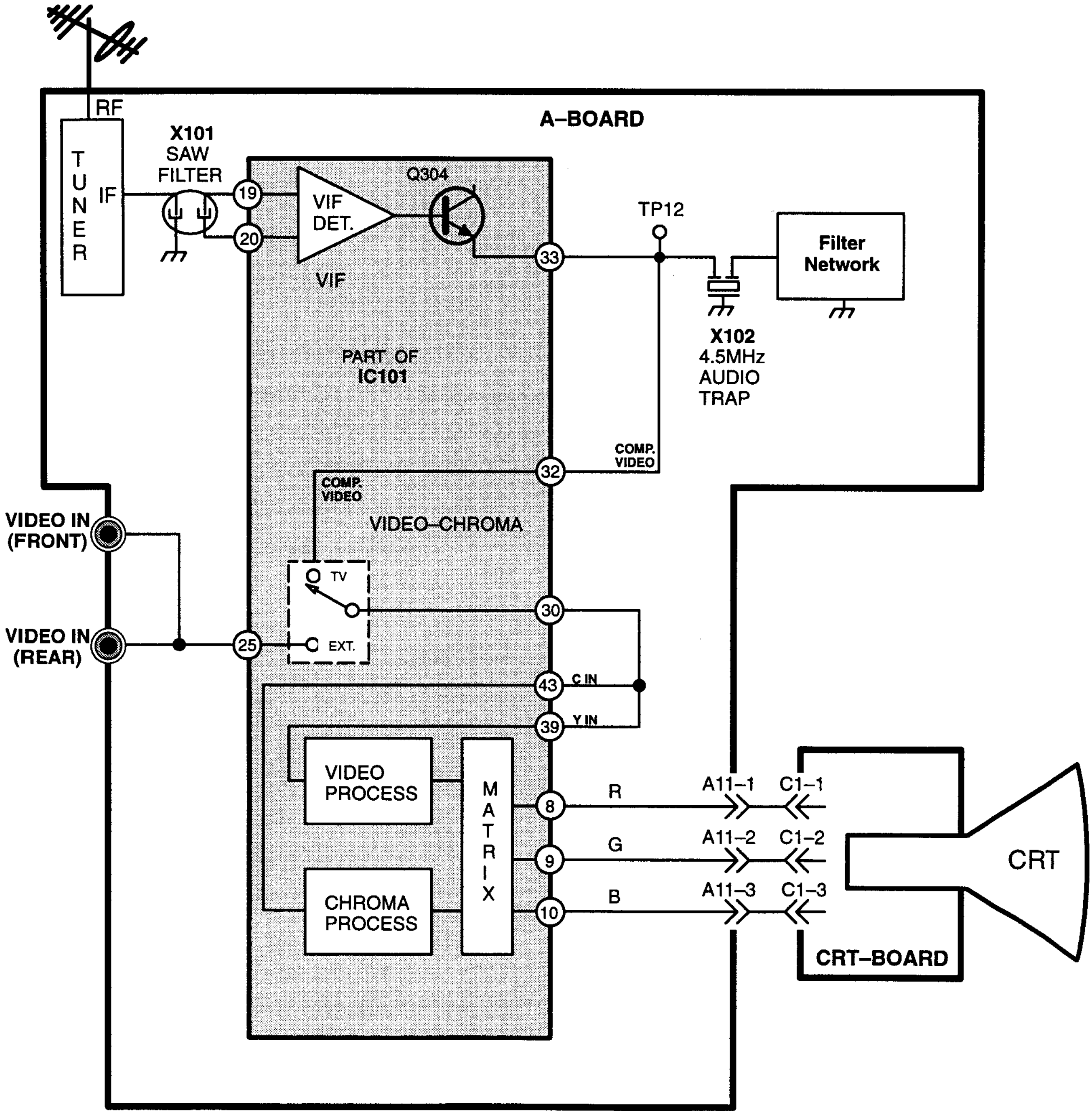
Adjust the FOCUS control to obtain the sharpest and clearest dot pattern.

a. adjust for best center.
b. adjust for best area between the center and top right corner.

IC001 MPU IN/OUT Pins and Functions
MN1873265T9S

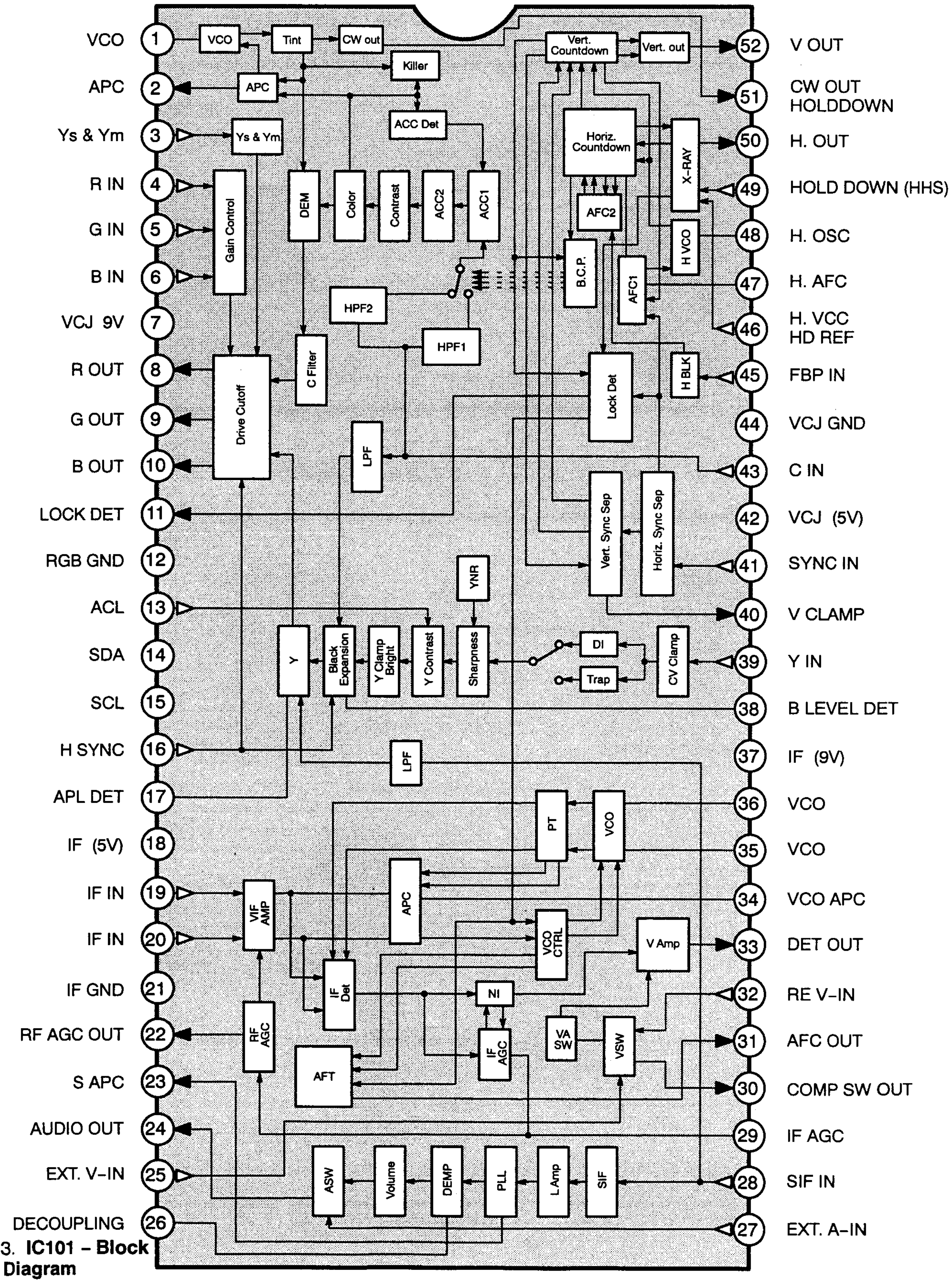
Remcon Signal	→	1	RMIN · P06	VSS	64	—	GND (system clock GND)
AFC <1st tuner>	→	2	ADIN0	OSC2	63	→	12MHz Xtal (or Ceramic OSC)
AFC <2st tuner>	→	3	ADIN1	OSC1	62	←	12MHz Xtal (or Ceramic OSC)
LOCK DETECT input <main>	→	4	P50	VDD	61	—	+5V
KEY-SCAN input 1	→	5	ADIN3	P00	60	→	SCL
Action/HSS	→	6	ADIN4	P01	59	↔	SDA
Version	→	7	ADIN5	P02	58	→	Version MSB
S-VHS input	→	8	P54	P03	57	→	Version ABL
not used (open)	←	9	P55	P04/IRQ0	56	→	not used (open)
FA1	→	10	ADIN8/P56	VSYNC/IRQ1	55	←	V. SYNC (negative polatiry)
MTS	→	11	ADIN9/P57	P07/RST	54	←	RESET
GND	→	12	CM	P60	53	→	MAIN AV select 1
Test OSC open	←	13	SYNC	P61	52	→	not used (open)
not used (open)	←	14	PWM1	P62	51	→	not used (open)
not used (open)	←	15	PWM2	P63	50	→	not used (open)
not used (open)	←	16	PWM3	P64	49	→	not used (open)
not used (open)	←	17	PWM4	P65	48	→	not used (open)
V-Size	←	18	PWM5	P66	47	→	not used (open)
not used (open)	←	19	PWM6	PWM/VOI	46	→	not used (open)
not used (open)	←	20	PWM7	SPWM	45	→	VOLUME
not used (open)	←	21	PWM8	VOW1	44	→	OSD Red
(Analog DAC VDD) +5V	—	22	AVDD	VOW2	43	→	OSD Green
(for CC)	←	23	CREF	VOW3	42	→	OSD Blue
not used (open)	←	24	VPH	VOB	41	→	OSD Blank (YS)
(for CC)	←	25	VCP	P16	40	→	Hold down detect
(Video signal for CC)	→	26	CVBS	HSYNC	39	←	H. SYNC (negative polarity)
GND	—	27	AVSS	VSS	38	—	GND
not used (open)	↔	28	P47	P20	37	→	AI Sound on/off
not used (open)	←	29	P46	P21	36	→	IF defeat
not used (open) (clone port)	←	30	P45	P40	35	→	RECHARGE
Power Relay on (H) / off (L)	←	31	P44	P41	34	←	Momentary power down
not used (open) (clone switch)	←	32	P43	P42	33	→	not used (open) (data in)

Video–Chroma Signal Path Block Diagram


RF
TUNER
IF
X101
SAW
FILTER
A–BOARD
Q304
19
20
VIF
DET.
VIF
33
TP12
Filter
Network
X102
4.5MHz
AUDIO
TRAP
PART OF
IC101
COMP.
VIDEO
32
COMP.
VIDEO
VIDEO–CHROMA
VIDEO IN
(FRONT)
VIDEO IN
(REAR)
TV
EXT.
25
30
43
C IN
39
Y IN
VIDEO
PROCESS
CHROMA
PROCESS
MATRIX
8
9
10
R
G
B
A11–1
C1–1
A11–2
C1–2
A11–3
C1–3
CRT
CRT–BOARD

IC101 Block Diagram

INPUT PINS = ◁ ▷ OUTPUT PINS = ◀ ▶

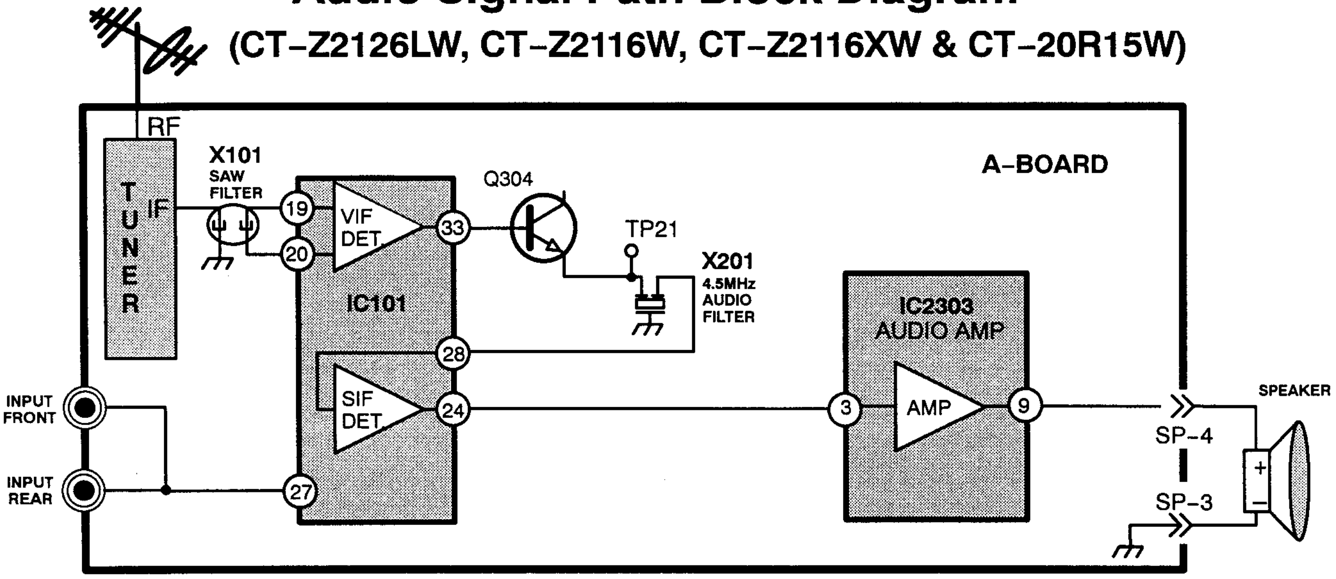


VCO ①
APC ②
Ys & Ym ③
R IN ④
G IN ⑤
B IN ⑥
VCJ 9V ⑦
R OUT ⑧
G OUT ⑨
B OUT ⑩
LOCK DET ⑪
RGB GND ⑫
ACL ⑬
SDA ⑭
SCL ⑮
H SYNC ⑯
APL DET ⑰
IF (5V) ⑱
IF IN ⑲
IF IN ⑳
IF GND ㉑
RF AGC OUT ㉒
S APC ㉓
AUDIO OUT ㉔
EXT. V-IN ㉕
DECOUPLING ㉖
㉗ EXT. A-IN
㉘ SIF IN
㉙ IF AGC
㉚ COMP SW OUT
㉛ AFC OUT
㉜ RE V-IN
㉝ DET OUT
㉞ VCO APC
㉟ VCO
㊱ VCO
㊲ IF (9V)
㊳ B LEVEL DET
㊴ Y IN
㊵ V CLAMP
㊶ SYNC IN
㊷ VCJ (5V)
㊸ C IN
㊹ VCJ GND
㊺ FBP IN
㊻ H. VCC HD REF
㊼ H. AFC
㊽ H. OSC
㊾ HOLD DOWN (HHS)
㊿ H. OUT
(51) CW OUT HOLDDOWN
(52) V OUT
VCO
Tint
CW out
Killer
APC
ACC Det
Ys & Ym
Gain Control
DEM
Color
Contrast
ACC2
ACC1
HPF2
HPF1
C Filter
Drive Cutoff
LPF
Vert. Countdown
Vert. out
Horiz. Countdown
X-RAY
AFC2
H VCO
B.C.P.
AFC1
H BLK
Lock Det
Vert. Sync Sep
Horiz. Sync Sep
YNR
Y
Black Expansion
Y Clamp Bright
Y Contrast
Sharpness
DI
Trap
CV Clamp
LPF
PT
VCO
APC
VIF AMP
VCO CTRL
V Amp
IF Det
NI
RF AGC
IF AGC
VA SW
VSW
AFT
ASW
Volume
DEMP
PLL
L Amp
SIF

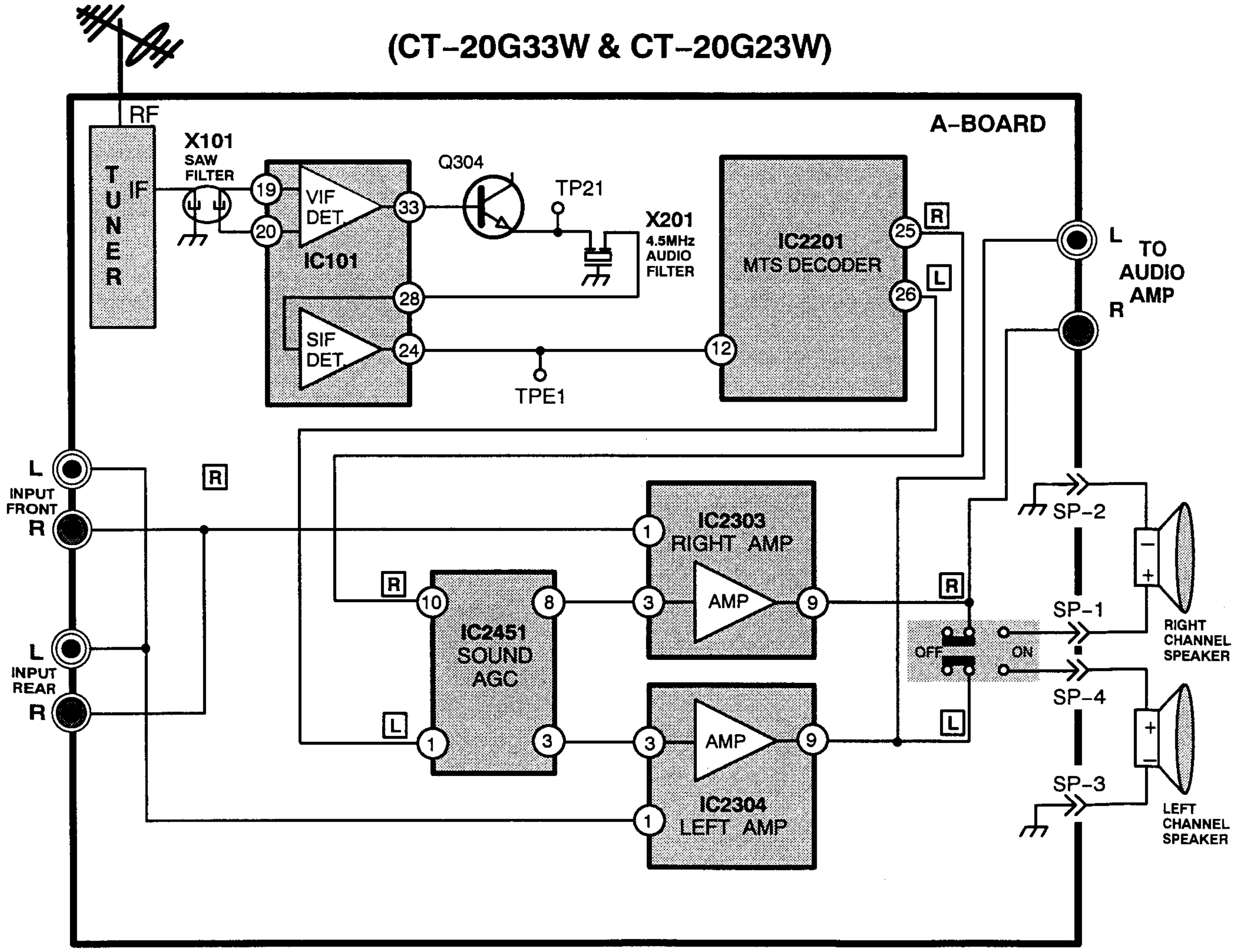
Figure 23. **IC101 - Block Diagram**

Audio Signal Path Block Diagram

(CT-Z2126LW, CT-Z2116W, CT-Z2116XW & CT-20R15W)


RF
TUNER
IF
X101
SAW FILTER
19
20
VIF DET
33
IC101
28
SIF DET
24
27
Q304
TP21
X201
4.5MHz AUDIO FILTER
A-BOARD
IC2303
AUDIO AMP
3
AMP
9
INPUT FRONT
INPUT REAR
SPEAKER
SP-4
SP-3
+
−

(CT-20G33W & CT-20G23W)


RF
TUNER
IF
X101
SAW FILTER
19
20
VIF DET
33
IC101
28
SIF DET
24
Q304
TP21
X201
4.5MHz AUDIO FILTER
TPE1
A-BOARD
IC2201
MTS DECODER
12
25
26
R
L
L
R
TO AUDIO AMP
INPUT FRONT
L
R
INPUT REAR
L
R
R
L
10
1
IC2451
SOUND AGC
8
3
IC2303
RIGHT AMP
1
3
AMP
9
IC2304
LEFT AMP
3
AMP
9
1
R
L
OFF
ON
SP-2
SP-1
SP-4
SP-3
RIGHT CHANNEL SPEAKER
LEFT CHANNEL SPEAKER
−
+
+
−

REPLACEMENT PARTS LIST

(Models: CT–20G13W/DW, CT–20G23W/DW, CT–20G33W & CT–20R15W/CW)

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF. NO.	PART NO.	DESCRIPTION
CAPRISTORS		
CRA801	**EXNG471P365**	**RES–CAP 470PF/3.6 MEG**
CRA802	**EXNG471P365**	**RES–CAP 470PF/3.6 MEG**
CAPACITORS		
C001	ECA1AM101	CAP,E 100UF/10V
C003	ECA1HM4R7	CAP,E 4.7UF/50V
C004	ECUX1H330JCX	CAP,C 33PF–J–50V
C005	ECUX1H330JCX	CAP,C 33PF–J–50V
C008	ECUX1H104ZFX	CAP,C .1UF–Z–50V
C010	TCUX1H103ZFN	CAP,C .01UF–Z–50V
C011	ECA1CM221	CAP,E 220UF/16V
C013	ECA0JM101	CAP,E 100UF/6.3V
C016	ECUX1H101JCX	CAP,C 100PF–J–50V
C017	ECUX1H220JCX	CAP,C 22PF–J–50V
C018	ECUX1H220JCX	CAP,C 22PF–J–50V
C019	ECA0JM101	CAP,E 100UF/6.3V
C020	ECA0JM101	CAP,E 100UF/6.3V
C022	ECA1CM471	CAP,E 470UF/16V
C024	ECA1EM4R7	CAP,E 4.7UF/25V
C025	ECUX1H101JCX	CAP,C 100PF–J–50V
C026	ECA1HM010	CAP,E 1.0UF/50V
C031	ECUX1H821KBX	CAP,C 820PF–K–50V
C032	ECA1AM470	CAP,E 47UF/10V
C033	ECUX1H101JCX	CAP,C 100PF–J–50V
C035	ECUX1H220JCX	CAP,C 22PF–J–50V
C036	ECUX1H220JCX	CAP,C 22PF–J–50V
C037	ECUX1H220JCX	CAP,C 22PF–J–50V
C038	ECUX1H220JCX	CAP,C 22PF–J–50V
C101	ECUX1H223ZFX	CAP,C .022UF–Z–50V
C102	ECA1EM100	CAP,E 10UF/25V
C103	ECUX1H300JCX	CAP,C 30PF–J–50V
C105	ECUX1H221JCX	CAP,C 220PF–J–50V
C106	ECA1HMR47	CAP,E .47UF/50V
C107	ECUX1H470JCX	CAP,C 47PF–J–50V
C108	ECA1HMR22	CAP,E .22UF/50V
C109	ECEA1HN4R7U	CAP,E 4.7UF/50V
C110	TCUX1H103ZFN	CAP,C .01UF–Z–50V
C111	ECA1EM100	CAP,E 10UF/25V
C113	ECA1EM100	CAP,E 10UF/25V
C117	ECUX1H070DCX	CAP,C 7PF–D–50V
C151	ECA1HMR22	CAP,E .22UF/50V
C201	TCUX1H103ZFN	CAP,C .01UF–Z–50V
C202	ECUX1H101JCX	CAP,C 100PF–J–50V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C202	ECUX1H562KBX	CAP,C .0056UF–K–50V *CT–20R15W CT–20R15CW*
C203	ECA1EM4R7	CAP,E 4.7UF/25V
C301	ECUX1H390JCX	CAP,C 39PF–J–50V
C302	ECEA1HN010U	CAP,E 1UF/50V
C304	ECEA1HNR47U	CAP,E .47UF–50V
C305	ECA1EM4R7	CAP,E 4.7UF/25V
C306	ECA1CM221	CAP,E 220UF/16V
C308	ECQB1H823KF	CAP,P .082UF–K–50V
C309	ECA1AM101	CAP,E 100UF/10V
C310	ECA1EM4R7	CAP,E 4.7UF/25V
C311	ECA1EM4R7	CAP,E 4.7UF/25V
C312	ECA1EM220	CAP,E 22UF/25V
C314	ECUX1H104ZFX	CAP,C .1UF–Z–50V
C351	TACCW391T50V	CAP,C 390PF/50V
C352	TACCW391T50V	CAP,C 390PF/50V
C353	TACCW471T50V	CAP,C 470PF/50V
C354	ECKD3D102KB	CAP,C .001UF–K–2KV
C357	ECEA1HN010U	CAP,E 1UF/50V
C401	ECQB1H153KF	CAP,P .015UF–K–50V
C402	ECUX1H471KBX	CAP,C 470PF–K–50V
C403	ECA1HM2R2	CAP,E 2.2UF/50V
C451	ECA1AM470	CAP,E 47UF/10V
C452	ECSF1EE105	CAP,T 1.0UF/25V
C453	ECEA1HFS2R2	CAP,E 2.2UF/50V
C454	ECA1EM102	CAP,E 1000UF/25V
C455	ECA1EHG101B	CAP,E 100UF–25V
C456	ECQB1H103JF	CAP,P .01UF–J–50V
C459	ECA1VM471	CAP,E 470UF/35V
C462	ECA1EM100	CAP,E 10UF/25V
C501	ECUX1H102KBX	CAP,C .001UF–K–50V
C502	ECQB1H223JF	CAP,P .022UF–J–50V
C503	ECA1HM2R2	CAP,E 2.2UF/50V
C504	ECUX1H101JCX	CAP,C 100PF–J–50V
C505	ECUX1H221JUX	CAP,C 220PF–J–50V
C506	ECA1CM221	CAP,E 220UF/16V
C508	ECUX1H121JCX	CAP,C 120PF–J–50V
C510	ECCD2H100D	CAP,C 10PF–D–500V
C511	ECKD2H821KB	CAP,C 820PF–K–500V
C512	ECKD2H101KB	CAP,C 100PF–K–500V
C531	**ECA1EM220**	**CAP,E 22UF/25V**
C532	ECA1AM102	CAP,E 1000UF/10V
C533	TCUX1H103ZFN	CAP,C .01UF–Z–50V
C534	TCUX1H103ZFN	CAP,C .01UF–Z–50V
C551	**ECA1VM331**	**CAP,E 330UF/35V**
C552	**ECA1EM221**	**CAP,E 220UF/25V** ***CT–20R15W CT–20R15CW***
C552	**ECA1EM471**	**CAP,E 470UF/25V** ***CT–20G33W*** ***CT–20G13W CT–20G13DW*** ***CT–20G23W CT–20G23DW***
C553	ECKD2H561KB	CAP,C 560PF–K–500V
C554	ECKD2H561KB	CAP,C 560PF–K–500V
C555	**ECEA2EU220**	**CAP,E 22UF/250V**
C556	**ECA1CM471**	**CAP,E 470UF/16V**
C557	ECKD2H222KB	CAP,C .0022UF–K–500V
C559	ECA1HM220	CAP,E 22UF/50V
C560	**ECEA1HN2R2U**	**CAP,E 2.2UF/50V**
C561	ECKD2H561KB	CAP,C 560PF–K–500V
C563	**ECWH12H822JS**	**CAP,P .0082UF–J–1.2KV**
C564	**ECKD3D102JB**	**CAP,C .001UF–J–2KV** ***CT–20R15W CT–20R15CW***
C564	**ECKD3D821JB**	**CAP,C 820PF–J–2KV** ***CT–20G33W*** ***CT–20G13W CT–20G13DW*** ***CT–20G23W CT–20G23DW***
C565	**ECKD3D102JB**	**CAP,C .001UF–J–2KV** ***CT–20R15W CT–20R15CW***

REPLACEMENT PARTS LIST

(Models: CT–20G13W/DW, CT–20G23W/DW, CT–20G33W & CT–20R15W/CW)

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF. NO.	PART NO.	DESCRIPTION
C565	**ECKD3D821JB**	**CAP,C 820PF–J–2KV** ***CT–20G33W*** ***CT–20G13W CT–20G13DW*** ***CT–20G23W CT–20G23DW***
C566	**ECKD3D181JB**	**CAP,C 180PF–J–2KV**
C569	**ECWF2394JBB**	**CAP,P .39UF–J–200V**
C571	ECA1EM220	CAP,E 22UF/25V
C572	ECA1EM100	CAP,E 10UF/25V
C573	ECA1CM101	CAP,E 100UF/16V
C601	ECUX1H181JCX	CAP,C 180PF–J–50V
C602	ECUX1H680JCX	CAP,C 68PF–J–50V
C604	ECUX1H150JUX	CAP,C 15PF–J–50V
C605	ECUX1H332KBX	CAP,C .0033UF–K–50V
C606	ECA1HM010	CAP,E 1.0UF/50V
C801	**ECKD2H472PU**	**CAP,C .0047UF–P–500V**
C802	**ECKD2H472PU**	**CAP,C .0047UF–P–500V**
C805	**EC0S2DG151DG**	**CAP,E 151UF/200V**
C806	**EC0S2DG151DG**	**CAP,E 151UF/200V**
C807	ECA1HM3R3	CAP,E 3.3UF/50V
C808	ECA1CM101	CAP,E 100UF/16V
C809	**EC0S2DG151DG**	**CAP,E 151UF/200V**
C810	**ECQU2A153MV**	**CAP,P .015UF–M–250V**
C811	**ECQU2A153MV**	**CAP,P .015UF–M–250V**
C812	**ECQU2A224MV**	**CAP,P .22UF–M–250V**
C814	ECQB1H333JF	CAP,P .033UF–J–50V
C815	ECA1HHG470B	CAP,E 47UF–50V
C818	ECKD3A821KB	CAP,C 820PF–K–1KVDC
C820	**ECA1JHG100B**	**CAP,E 10UF–63V**
C823	**ECEA160V33Z**	**CAP,E 33UF/160V**
C824	ECKD3A331KB	CAP,C 330PF–K–1KV
C825	ECKD3A471KB	CAP,C 470PF–K–1KV
C2201	AP335K016CAE	CAP,T 3.3UF/16V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2202	ECA1EM4R7	CAP,E 4.7UF/25V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2203	ECA1HM010	CAP,E 1.0UF/50V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2204	ECA1EM4R7	CAP,E 4.7UF/25V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2205	ECA1EM4R7	CAP,E 4.7UF/25V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2206	ECA1EM4R7	CAP,E 4.7UF/25V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2207	ECA1EM4R7	CAP,E 4.7UF/25V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2208	ECA1EM4R7	CAP,E 4.7UF/25V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2209	ECA1AM101	CAP,E 100UF/10V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2210	ECA1HMR33	CAP,E .33UF/50V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2211	ECEA1HUR68	CAP,E .68UF/50V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2212	ECA1HM2R2	CAP,E 2.2UF/50V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2213	ECA1EM100	CAP,E 10UF/25V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2214	ECQB1H104JF	CAP,P .1UF–J–50V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2215	ECQB1H223JF	CAP,P .022UF–J–50V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2216	ECUX1H332KBX	CAP,C .0033UF–K–50V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2217	ECEA1HN010U	CAP,E 1UF/50V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2218	ECEA1HN010U	CAP,E 1UF/50V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2219	AP106K016CAE	CAP,T 10UF/16V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2220	ECEA1CN100U	CAP,E 10UF–16V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2221	TCUX1H103KBN	CAP,C .01UF–K–50V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2222	ECUX1H472KBX	CAP,C .0047UF–K–50V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2301	ECA1EM471	CAP,E 470UF/25V *CT–20R15W CT–20R15CW*
C2302	ECA1HHG3R3B	CAP,E 3.3UF–50V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2302	ECA1HM3R3	CAP,E 3.3UF/50V *CT–20R15W CT–20R15CW*
C2303	ECA1EHG100B	CAP,E 10UF–25V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2303	ECA1EM100	CAP,E 10UF/25V *CT–20R15W CT–20R15CW*
C2304	ECQB1H104JF	CAP,P .1UF–J–50V
C2306	ECA1CM221	CAP,E 220UF/16V

REPLACEMENT PARTS LIST

(Models: CT–20G13W/DW, CT–20G23W/DW, CT–20G33W & CT–20R15W/CW)

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REF. NO.	PART NO.	DESCRIPTION
C2307	ECEA1HN010U	CAP,E 1UF/50V
C2309	ECA1HHG010B	CAP,E 1UF–50V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2309	ECA1HM010	CAP,E 1.0UF/50V *CT–20R15W CT–20R15CW*
C2310	ECUX1H332KBX	CAP,C .0033UF–K–50V
C2311	ECA1HM3R3	CAP,E 3.3UF/50V
C2351	ECA1EM102	CAP,E 1000UF/25V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2352	ECA1HHG3R3B	CAP,E 3.3UF–50V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2353	ECA1EHG100B	CAP,E 10UF–25V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2354	ECQB1H104JF	CAP,P .1UF–J–50V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2356	ECA1CM221	CAP,E 220UF/16V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2357	ECEA1HN010U	CAP,E 1UF/50V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2358	ECUX1H332KBX	CAP,C .0033UF–K–50V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C2451	ECA1EM100	CAP,E 10UF/25V *CT–20G33W* *CT–20G23W CT–20G23DW*
C2452	ECA1EM100	CAP,E 10UF/25V *CT–20G33W* *CT–20G23W CT–20G23DW*
C2453	ECA1EM4R7	CAP,E 4.7UF/25V *CT–20G33W* *CT–20G23W CT–20G23DW*
C2454	ECA1CM221	CAP,E 220UF/16V *CT–20G33W* *CT–20G23W CT–20G23DW*
C3001	ECA1HM010	CAP,E 1.0UF/50V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C3001	ECA1HM100	CAP,E 10UF/50V *CT–20R15W CT–20R15CW*
C3002	ECA1HM010	CAP,E 1.0UF/50V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
C3003	ECA1HM010	CAP,E 1.0UF/50V
C3005	ECUX1H272KBX	CAP,C .0027UF–K–50V
C3006	ECUX1H272KBX	CAP,C .0027UF–K–50V *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
		DIODES
D001	ERA15–01	DIODE
D002	MA165	DIODE
D003	MA4047H	DIODE
D006	MA4330H	DIODE
D008	MA165	DIODE

REF. NO.	PART NO.	DESCRIPTION
D009	MA165	DIODE
D011	MA165	DIODE
D014	MA165	DIODE
D015	MA165	DIODE
D016	MA165	DIODE
D017	MA165	DIODE
D052	MA4068M	DIODE, ZENER
D451	ERA15–01	DIODE
D452	MA4047M	DIODE, ZENER
D501	MA4082L	DIODE
D531	**AS01**	**DIODE**
D532	**MA4062L**	**DIODE**
D551	**TVSRU2N**	**DIODE**
D553	**AU02**	**DIODE**
D554	**AU02**	**DIODE**
D555	MA165	DIODE
D556	MA4360H	DIODE, ZENER
D560	MA165	DIODE
D561	**AU02**	**DIODE**
D801	**EM02BM**	**DIODE**
D802	**EM02BM**	**DIODE**
D806	MA4047H	DIODE
D807	MA165	DIODE
D810	**TAP104XM05**	**PTC**
D820	EU02V1	DIODE
D821	EU02V1	DIODE
D822	EU02V1	DIODE
D823	RL30A	DIODE
D824	EU02V1	DIODE
D825	**TVSSR2KL**	**DIODE, PROTECTION**
D826	EU02V1	DIODE
D829	MA165	DIODE
D2301	MA165	DIODE
D2302	MA165	DIODE
D2312	MA4068M	DIODE, ZENER
D3001	MA165	DIODE
D3002	MA4110M	DIODE, ZENER
D3004	MA4110M	DIODE, ZENER
D3005	MA4110M	DIODE, ZENER *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
D3006	MA4110M	DIODE, ZENER
D3007	MA4110M	DIODE, ZENER
D3008	MA4110M	DIODE, ZENER
D3009	MA4110M	DIODE, ZENER
D3010	MA4110M	DIODE, ZENER *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
D3011	MA4110M	DIODE, ZENER *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
D3012	MA4110M	DIODE, ZENER *CT–20G33W* *CT–20G23W CT–20G23DW*
D3013	MA3110M	DIODE, ZENER *CT–20G33W* *CT–20G23W CT–20G23DW*

REPLACEMENT PARTS LIST

(Models: CT–20G13W/DW, CT–20G23W/DW, CT–20G33W & CT–20R15W/CW)

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REF. NO.	PART NO.	DESCRIPTION
D3014	MA3110M	DIODE, ZENER *CT–20G33W* *CT–20G23W CT–20G23DW*
D3015	MA3110M	DIODE, ZENER *CT–20G33W* *CT–20G23W CT–20G23DW*
D3016	MA3056M	DIODE
FUSES		
F801	**0BA1C63NU100**	**FUSE, 6.3A/125V**
INTEGRATED CIRCUITS		
IC001	**MN1874085T9S**	**INT CKT**
IC002	24LC04BIP	INT CKT
IC003	PIC–12042SRB	RECEIVER, REMOTE CONTROL
IC101	**AN5165K**	**INT CKT**
IC451	**LA7837–TV**	**INT CKT**
IC551	**AN78M09**	**PLUS 9V AVR**
IC552	AN78M05	PLUS 5V AVR
IC801	**0N3131R**	**INT CKT**
IC803	**STR58041A**	**INT CKT**
IC2201	AN5819K	INT CKT *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
IC2303	LA4285	INT CKT
IC2304	LA4285	INT CKT *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
IC2451	AN5285K	INT CKT *CT–20G33W* *CT–20G23W CT–20G23DW*
COILS		
L001	TLTABTA2R2K	COIL, PEAKING
L002	ELESN390KA	COIL, PEAKING 39UH
L003	TLTABTA2R2K	COIL, PEAKING
L004	TLTABTA2R2K	COIL, PEAKING
L006	TSKA072	FERRITE BEAD
L008	TLTABTA470K	COIL, PEAKING
L009	TSKA074	FERRITE BEAD
L103	TLTABTA120K	COIL, PEAKING
L104	TLTABTA1R0K	COIL, PEAKING
L105	EIV7EN053B	COIL, VCO
L106	ELESN180JA	COIL, PEAKING 18UH
L551	**ELH5L4101**	**COIL**
L602	ELESN120JA	COIL, PEAKING 12UH
L801	**ELF15N013A**	**LINE FILTER**
L802	ELEIE680KA	COIL, PEAKING 68UH
L804	TSKA076	FERRITE BEAD
L2201	ELESN102JA	COIL, PEAKING 1000UH *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW* *CT–20G33W*
L2202	ELESN471JA	COIL, PEAKING 470UH *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW* *CT–20G33W*
L2301	TSKA064	FERRITE BEAD
L2302	TLTABTA2R2K	COIL, PEAKING
J214	EXCELSA24T	FERRITE BEAD
J241	EXCELSA24T	FERRITE BEAD

REF. NO.	PART NO.	DESCRIPTION
TRANSISTORS		
Q001	MSD601–RT1	TRANSISTOR
Q002	JC501PQ	TRANSISTOR
Q003	MSB709–RT1	TRANSISTOR
Q004	MSB709–RT1	TRANSISTOR
Q302	MSD601–RT1	TRANSISTOR
Q304	MSD601–RT1	TRANSISTOR
Q351	2SC3063	TRANSISTOR
Q352	2SC3063	TRANSISTOR
Q353	2SC3063	TRANSISTOR
Q430	MSD601–RT1	TRANSISTOR
Q451	MSD601–RT1	TRANSISTOR
Q452	MSD601–RT1	TRANSISTOR
Q501	2SC1573AH	TRANSISTOR
Q551	**2SD2499MA2**	**TRANSISTOR**
Q801	2SC1685RSTA	TRANSISTOR
Q802	2SC1685RSTA	TRANSISTOR
Q804	2SA1767Q	TRANSISTOR
Q2309	MSB709–RT1	TRANSISTOR
Q3001	MSD601–RT1	TRANSISTOR
RELAYS		
RL801	**TSEH8007**	**RELAY**
RESISTORS		
R002	ERJ6GEYJ182	RES,M 1.8K–J–1/10
R003	ERJ6GEYJ562	RES,M 5.6K–J–1/10
R004	ERDS1TJ181	RES,C 180–J–1/2
R005	ERDS2TJ101	RES,C 100–J–1/4
R006	ERJ6GEYJ102	RES,M 1K–J–1/10
R007	ERJ6GEYJ102	RES,M 1K–J–1/10
R008	ERJ6GEYJ562	RES,M 5.6K–J–1/10
R010	ERJ6GEYJ154	RES,M 150K–J–1/10
R011	ERJ6GEYJ684	RES,M 680K–J–1/10
R012	ERJ6GEYJ473	RES,M 47K–J–1/10
R014	ERJ6GEYJ472	RES,M 4.7K–J–1/10
R015	ERJ6GEYJ472	RES,M 4.7K–J–1/10
R016	ERJ6GEYJ472	RES,M 4.7K–J–1/10
R017	ERJ6GEYJ472	RES,M 4.7K–J–1/10
R020	ERJ6GEYJ474	RES,M 470K–J–1/10
R021	ERJ6GEYJ101	RES,M 100–J–1/10
R022	ERJ6GEYJ101	RES,M 100–J–1/10
R023	ERJ6GEYJ102	RES,M 1K–J–1/10
R025	ERJ6GEYJ223	RES,M 22K–J–1/10
R026	ERJ6GEYJ103	RES,M 10K–J–1/10 *CT–20G33W* *CT–20G23W CT–20G23DW*
R026	ERJ6GEYJ133	RES,M 13K–J–1/10 *CT–20G13W CT–20G13DW*
R026	ERJ6GEYJ333	RES,M 33K–J–1/10 *CT–20R15W CT–20R15CW*
R027	ERJ6GEYJ103	RES,M 10K–J–1/10 *CT–20G13W CT–20G13DW*
R027	ERJ6GEYJ133	RES,M 13K–J–1/10 *CT–20G33W* *CT–20G23W CT–20G23DW*
R027	ERJ6GEYJ752	RES,M 7.5K–J–1/10 *CT–20R15W CT–20R15CW*
R028	ERJ6GEYJ103	RES,M 10K–J–1/10
R030	ERJ6GEYJ102	RES,M 1K–J–1/10

REPLACEMENT PARTS LIST

(Models: CT–20G13W/DW, CT–20G23W/DW, CT–20G33W & CT–20R15W/CW)

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REF. NO.	PART NO.	DESCRIPTION
R032	ER0S2CKF1002	RES,M 10K–F–1/4
R033	ERJ6GEYJ222	RES,M 2.2K–J–1/10
R034	ERJ6GEYJ222	RES,M 2.2K–J–1/10
R035	ERJ6GEYJ332	RES,M 3.3K–J–1/10
R036	ERJ6GEYJ562	RES,M 5.6K–J–1/10
R037	ERJ6GEYJ103	RES,M 10K–J–1/10
R038	ERJ6GEYJ223	RES,M 22K–J–1/10
R039	ERDS2TJ102	RES,C 1K–J–1/4
R046	ERDS2TJ102	RES,C 1K–J–1/4
R048	ERJ6GEYJ221	RES,M 220–J–1/10
R049	ERJ6GEYJ221	RES,M 220–J–1/10
R053	ERJ6GEYJ103	RES,M 10K–J–1/10
R055	ERJ6GEYJ103	RES,M 10K–J–1/10
R060	ERJ6GEYJ102	RES,M 1K–J–1/10
R065	ERJ6GEYJ471	RES,M 470–J–1/10
R066	ERJ6GEYJ222	RES,M 2.2K–J–1/10
R067	ERJ6GEYJ222	RES,M 2.2K–J–1/10
R068	ERJ6GEYJ222	RES,M 2.2K–J–1/10
R070	ERJ6GEYJ101	RES,M 100–J–1/10
R101	ERJ6GEYJ750	RES,M 75–J–1/10
R102	ERJ6GEYJ683	RES,M 68K–J–1/10
R103	ERJ6GEYJ183	RES,M 18K–J–1/10
R104	ERJ6GEYJ681	RES,M 680–J–1/10
R105	ERJ6GEYJ681	RES,M 680–J–1/10
R107	ERJ6GEYJ222	RES,M 2.2K–J–1/10
R108	ERJ6GEYJ471	RES,M 470–J–1/10
R152	ERDS2TJ183	RES,C 18K–J–1/4
R153	ERJ6GEYJ223	RES,M 22K–J–1/10
R154	ERJ6GEYJ393	RES,M 39K–J–1/10
R201	ERJ6GEYJ471	RES,M 470–J–1/10
R202	ERJ6GEYJ682	RES,M 6.8K–J–1/10
R203	ERJ6GEYJ562	RES,M 5.6K–J–1/10 *CT–20G33W* *CT–20G13W* *CT–20G13DW* *CT–20G23W* *CT–20G23DW*
R303	ERJ6GEYJ682	RES,M 6.8K–J–1/10
R304	ERJ6GEYJ332	RES,M 3.3K–J–1/10
R305	ER0S2CKF3001	RES,M 3K–F–1/4
R306	ERJ6ENF1651	RES,M 1.65K–F–1/10
R307	ERJ6GEYJ564	RES,M 560K–J–1/10
R308	ERJ6GEYJ102	RES,M 1K–J–1/10
R309	ERJ6GEYJ333	RES,M 33K–J–1/10
R310	ERJ6GEYJ223	RES,M 22K–J–1/10
R311	ERJ6GEYJ185	RES,M 1.8MEG–J–1/10W
R317	ERJ6GEYJ684	RES,M 680K–J–1/10
R319	ERJ6GEYJ122	RES,M 1.2K–J–1/10
R320	ERJ6GEYJ102	RES,M 1K–J–1/10
R351	ERG2FJ123H	RES,M 12K–J–2W
R352	ERG2FJ123H	RES,M 12K–J–2W
R353	ERG2FJ123H	RES,M 12K–J–2W
R354	ERDS1TJ272	RES,C 2.7K–J–1/2
R355	ERDS1TJ272	RES,C 2.7K–J–1/2
R356	ERDS1TJ272	RES,C 2.7K–J–1/2
R357	ERDS2TJ301	RES,C 300–J–1/4
R358	ERDS2TJ301	RES,C 300–J–1/4
R359	ERDS2TJ301	RES,C 300–J–1/4
R360	ERDS2TJ102	RES,C 1K–J–1/4
R361	ERDS2TJ102	RES,C 1K–J–1/4
R362	ERDS2TJ102	RES,C 1K–J–1/4
R363	ERDS2TJ101	RES,C 100–J–1/4
R364	ERDS2TJ101	RES,C 100–J–1/4
R365	ERDS2TJ101	RES,C 100–J–1/4
R401	ERJ6GEYJ102	RES,M 1K–J–1/10
R430	ERJ6GEYJ103	RES,M 10K–J–1/10
R432	ERJ6GEYJ102	RES,M 1K–J–1/10
R451	ERDS1FJ1R2	RES,C 1.2–J–1/2
R454	ERJ6GEYJ473	RES,M 47K–J–1/10
R455	ERJ6GEYJ153	RES,M 15K–J–1/10
R456	ERJ6GEYJ562	RES,M 5.6K–J–1/10
R457	ERJ6GEYJ911	RES,M 910–J–1/10
R458	ERJ6GEYJ273	RES,M 27K–J–1/10
R459	ERJ6GEYJ683	RES,M 68K–J–1/10
R460	ERDS2TJ102	RES,C 1K–J–1/4
R462	ERJ6GEYJ473	RES,M 47K–J–1/10
R463	ERJ6GEYJ473	RES,M 47K–J–1/10
R465	ERJ6GEYJ103	RES,M 10K–J–1/10
R466	ERJ6GEYJ103	RES,M 10K–J–1/10
R467	ERJ6GEYJ104	RES,M 100K–J–1/10
R468	ERJ6GEYJ101	RES,M 100–J–1/10
R469	ERJ6GEYJ220	RES,M 22–J–1/10
R470	ERDS2TJ152	RES,C 1.5K–J–1/4
R471	ERJ6GEYJ223	RES,M 22K–J–1/10
R501	ERJ6GEYJ102	RES,M 1K–J–1/10
R502	ERDS2TJ562	RES,C 5.6K–J–1/4
R503	ERJ6GEYJ822	RES,M 8.2K–J–1/10
R504	ERJ6GEYJ821	RES,M 820–J–1/10
R505	ERJ6GEYJ472	RES,M 4.7K–J–1/10
R506	ERJ6GEYJ182	RES,M 1.8K–J–1/10
R507	ERJ6GEYJ392	RES,M 3.9K–J–1/10
R508	ERJ6GEYJ562	RES,M 5.6K–J–1/10
R509	ERDS2TJ331	RES,C 330–J–1/4
R510	**ERG3FJ272H**	**RES,M 2.7K–J–3W**
R512	ERG2FJ562H	RES,M 5.6K–J–2W
R531	**ERD25FJ470**	**RES,C 47–J–1/4**
R532	**ERJ6ENF4532**	**RES,M 45.3K–F–1/10W** ***CT–20R15W*** ***CT–20R15CW***
R532	**ERJ6ENF4702**	**RES,M 47K–F–1/10** ***CT–20G33W*** ***CT–20G13W*** ***CT–20G13DW*** ***CT–20G23W*** ***CT–20G23DW***
R533	**ERJ6ENF1502**	**RES,M 15K–F–1/10W**
R536	ERJ6GEYJ223	RES,M 22K–J–1/10
R537	ERJ6GEYJ473	RES,M 47K–J–1/10
R551	**ERDS1FJ1R0**	**RES,C 1.0–J–1/2**
R552	**ERDS1FJ1R0**	**RES,C 1.0–J–1/2**
R553	**ERDS1FJ1R0**	**RES,C 1.0–J–1/2**
R554	ERG2FJ390H	RES,M 39–J–2W
R555	ERDS1FJ101	RES,C 100–J–1/2
R556	ERDS2TJ332	RES,C 3.3K–J–1/4
R557	ERDS2TJ103	RES,C 10K–J–1/4
R558	**ERQ2CJP2R0**	**RES,F 2.0–J–2W** ***CT–20R15W*** ***CT–20R15CW***

REPLACEMENT PARTS LIST

(Models: CT–20G13W/DW, CT–20G23W/DW, CT–20G33W & CT–20R15W/CW)

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF. NO.	PART NO.	DESCRIPTION
R558	**ERQ2CJP2R4**	**RES,F 2.4–J–2W** ***CT–20G33W*** ***CT–20G13W CT–20G13DW*** ***CT–20G23W CT–20G23DW***
R559	ERG2FJ683H	RES,M 12K–J–2W
R560	ERDS1FJ182	RES,C 1.8K–J–1/2
R563	ERDS2TJ124	RES,C 120K–J–1/4
R564	ERDS2TJ104	RES,C 100K–J–1/4
R565	ERDS2TJ103	RES,C 10K–J–1/4
R567	ERG2FJ122H	RES,M 12K–J–2W
R602	ERJ6GEYJ331	RES,M 330–J–1/10
R603	ERJ6GEYJ331	RES,M 330–J–1/10
R604	ERJ6GEYJ331	RES,M 330–J–1/10
R614	ERJ6GEYJ332	RES,M 3.3K–J–1/10
R801	**ERF7ZK1R5**	**RES,W 1.5–K–7W**
R805	ERDS2TJ274	RES,C 270K–J–1/4
R806	ERDS2TJ274	RES,C 270K–J–1/4
R808	ERDS1FJ1R5	RES,C 1.5–J–1/2
R809	ERDS1FJ1R5	RES,C 1.5–J–1/2
R810	ERDS1FJ272	RES,C 2.7K–J–1/2
R812	ERDS1TJ183	RES,C 18K–J–1/2
R813	ERJ6GEYJ562	RES,M 5.6K–J–1/10
R815	**ERC12ZGM825**	**RES,S 8.2MEG–M–1/2**
R817	**ERX3FJ4R7**	**RES,M 4.7–J–3W**
R820	ERJ6GEYJ153	RES,M 15K–J–1/10
R821	ERJ6GEYJ392	RES,M 3.9K–J–1/10
R822	ERD50FJ474	RES,C 470K–J–1/2W
R823	ERDS2TJ222	RES,C 2.2K–J–1/4
R824	ERG3FJ680	RES,M 68–J–3W
R825	ERDS2TJ102	RES,C 1K–J–1/4
R826	ERF2AKR33	RES,W .33–K–2W
R827	ERDS1FJ561	RES,C 560–J–1/2
R828	ERG3FJ470H	RES,M 47–J–3W
R829	ERQ14AJ270	RES,F 27–J–1/4
R2201	ERJ6GEYJ472	RES,M 4.7K–J–1/10 *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
R2202	ERJ6GEYJ153	RES,M 15K–J–1/10 *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
R2203	ERJ6GEYJ104	RES,M 100K–J–1/10 *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
R2204	ERJ6GEYJ473	RES,M 47K–J–1/10 *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
R2205	ERJ6GEYJ154	RES,M 150K–J–1/10 *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
R2206	ERJ6GEYJ102	RES,M 1K–J–1/10 *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
R2207	ERJ6GEYJ102	RES,M 1K–J–1/10 *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
R2208	ERJ6ENF9102	RES,M 91K–F–1/10 *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
R2212	ERJ6GEYJ682	RES,M 6.8K–J–1/10 *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
R2301	ERQ2CJP120	RES,F 12–J–2W
R2303	ERD25FJ1R0	RES,C 1.0–J–1/4
R2306	ERJ6GEYJ682	RES,M 6.8K–J–1/10
R2311	ERJ6GEYJ332	RES,M 3.3K–J–1/10
R2312	ERJ6GEYJ682	RES,M 6.8K–J–1/10
R2313	ERJ6GEYJ683	RES,M 68K–J–1/10
R2314	ERJ6GEYJ104	RES,M 100K–J–1/10
R2317	ERJ6GEYJ561	RES,M 560–J–1/10
R2318	ERJ6GEYJ103	RES,M 10K–J–1/10
R2319	ERDS2TJ562	RES,C 5.6K–J–1/4
R2321	ERDS2TJ101	RES,C 100–J–1/4
R2322	ERJ6GEYJ472	RES,M 4.7K–J–1/10
R2353	ERD25FJ1R0	RES,C 1.0–J–1/4 *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
R2356	ERJ6GEYJ682	RES,M 6.8K–J–1/10 *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
R2357	ERJ6GEYJ103	RES,M 10K–J–1/10 *CT–20G33W* *CT–20G23W CT–20G23DW*
R2358	ERJ6GEYJ122	RES,M 1.2K–J–1/10 *CT–20G33W* *CT–20G23W CT–20G23DW*
R2359	ERJ6GEYJ103	RES,M 10K–J–1/10 *CT–20G33W* *CT–20G23W CT–20G23DW*
R2360	ERJ6GEYJ122	RES,M 1.2K–J–1/10 *CT–20G33W* *CT–20G23W CT–20G23DW*
R2361	ERJ6GEYJ681	RES,M 680–J–1/10 *CT–20G33W* *CT–20G23W CT–20G23DW*
R2362	ERJ6GEYJ681	RES,M 680–J–1/10 *CT–20G33W* *CT–20G23W CT–20G23DW*
R2451	ERJ6GEYJ225	RES,M 2.2MEG–J–1/10 *CT–20G33W* *CT–20G23W CT–20G23DW*
R2455	ERJ6GEYJ243	RES,M 24K–J–1/10 *CT–20G33W* *CT–20G23W CT–20G23DW*
R2456	ERJ6GEYJ223	RES,M 22K–J–1/10 *CT–20G33W* *CT–20G23W CT–20G23DW*
R3001	ERJ6GEYJ473	RES,M 47K–J–1/10
R3002	ERJ6GEYJ104	RES,M 100K–J–1/10
R3005	ERDS2TJ750	RES,C 75–J–1/4
R3006	ERDS2TJ391	RES,C 390–J–1/4
R3009	ERDS2TJ682	RES,C 6.8K–J–1/4
R3010	ERJ6GEYJ334	RES,M 330K–J–1/10
R3011	ERDS2TJ682	RES,C 6.8K–J–1/4 *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
R3012	ERDS2TJ334	RES,C 330K–J–1/4 *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
R3013	ERDS2TJ682	RES,C 6.8K–J–1/4

REPLACEMENT PARTS LIST

(Models: CT–20G13W/DW, CT–20G23W/DW, CT–20G33W & CT–20R15W/CW)

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF. NO.	PART NO.	DESCRIPTION
R3014	ERDS2TJ682	RES,C 6.8K–J–1/4 *CT–20G33W* *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
		SWITCHES
S001	EVQPF106K	SWITCH *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW* *CT–20R15W CT–20R15CW*
S001	EVQQKH06K	SWITCH, PUSH *CT–20G33W*
S002	EVQPF106K	SWITCH *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW* *CT–20R15W CT–20R15CW*
S002	EVQQKH06K	SWITCH, PUSH *CT–20G33W*
S003	EVQPF106K	SWITCH *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW* *CT–20R15W CT–20R15CW*
S003	EVQQKH06K	SWITCH, PUSH *CT–20G33W*
S004	EVQPF106K	SWITCH *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW* *CT–20R15W CT–20R15CW*
S004	EVQQKH06K	SWITCH, PUSH *CT–20G33W*
S005	EVQPF106K	SWITCH *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW* *CT–20R15W CT–20R15CW*
S005	EVQQKH06K	SWITCH, PUSH *CT–20G33W*
S006	EVQQKH06K	SWITCH, PUSH *CT–20G33W*
S007	EVQQKH06K	SWITCH, PUSH *CT–20G33W*
S008	EVQPF106K	SWITCH *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW* *CT–20R15W CT–20R15CW*
S009	EVQPF106K	SWITCH *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW* *CT–20R15W CT–20R15CW*
S2301	ESB621283	SWITCH, CATV *CT–20G33W* *CT–20G23W CT–20G23DW*
		TRANSFORMERS
T001	**TLP16297**	**TRANSFORMER, POWER SUPPLY**
T501	**ETH19Y70AYM**	**TRANSFORMER, HORIZONTAL DRIVER**
T502	**ETE19Z30AY**	**TRANSFORMER, HORIZONTAL COUPLING**
T551	**KFT3AB119F**	**TRANSFORMER, FLYBACK**
T801	**ETS25AD129NC**	**TRANSFORMER**
		CRYSTALS/FILTERS
X001	TSS2080MX	CRYSTAL, 12 MHZ CLOCK
X101	M1969M	SAW FILTER
X102	EFCWS4504AB	FILTER 4.5MHZ
X201	EFCS4R5MS4	FILTER 4.5MHZ BANDPASS *CT–20R15W CT–20R15CW*
X201	EFCS4R5MS5W	FILTER 4.5MHZ BANDPASS *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW* *CT–20G33W*
X501	TAFCSB503F38	CRYSTAL, CLOCK
X601	TSS2AA001	CRYSTAL, 3.58MHZ
		OTHERS
M001	**A51KQN011X**	**CRT 20"** ***CT–20G33W*** ***CT–20G13W CT–20G13DW*** ***CT–20G23W CT–20G23DW***
M002	**A51KRE89XDT**	**CRT 20"** ***CT–20R15W CT–20R15CW***
M003	EAGG1202B2	SPEAKER *CT–20G33W*
M004	EASG9D550B2	SPEAKER *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW* *CT–20R15W CT–20R15CW*
M005	TKP2A11172	SPEAKER GRILLE *CT–20G33W*
TNR001	**ENV56D37G3**	**TUNER**
M006	ETC33X82NA	YOKE, CONVERGENCE *CT–20R15W CT–20R15CW*
M007	EUR501371	TRANSMITTER, REMOTE CONTROL *CT–20G13W CT–20G13DW* *CT–20R15W CT–20R15CW*
M008	EUR511112	TRANSMITTER, REMOTE CONTROL *CT–20G23W CT–20G23DW* *CT–20G33W*
M009	UR50EC1151A	BATTERY COVER, REMOTE *CT–20G13W CT–20G13DW* *CT–20R15W CT–20R15CW*
M010	UR51EC883A	BATTERY COVER, REMOTE *CT–20G23W CT–20G23DW* *CT–20G33W*
M011	TBM2A10141	BADGE, PANASONIC
M012	TBX1886601	PUSHBUTTON, SPEAKER *CT–20G23W CT–20G23DW* *CT–20G33W*
M013	TBX2AA00301G	BUTTON, 7-KEY *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
M014	TBX2AA00401G	BUTTON, 7-KEY *CT–20R15W CT–20R15CW*
M015	TBX2A50153	BUTTON, KEYBOARD *CT–20G33W*
M016	**TJSC00300**	**CRT SOCKET**
M017	TMM2A30702	WEDGE, YOKE
M018	TMW2A97121	STRAIN RELIEF: AC LINE CORD *CT–20G33W*
M019	TQB2AA0263	MANUAL, OWNERS (ENG/SP) *CT–20G13W CT–20G23W* *CT–20G33W CT–20R15W*
M020	TQB2AA0264	MANUAL, OWNERS (ENG/FR) *CT–20G13DW CT–20G23DW* *CT–20R15CW*
M021	TQB2AA7011	SHEET, INSTRUCTION REMOTE *CT–20G13W CT–20R15W*

REPLACEMENT PARTS LIST

(Models: CT–20G13W/DW, CT–20G23W/DW, CT–20G33W & CT–20R15W/CW)

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF. NO.	PART NO.	DESCRIPTION
M022	TQB2AA7012	SHEET, INSTRUCTION REMOTE *CT–20G23W CT–20G33W*
M023	TQB2AA7013	SHEET, INSTRUCTION REMOTE (E/F) *CT–20G13DW CT–20R15CW*
M024	TQB2AA7014	SHEET, INSTRUCTION REMOTE (E/F) *CT–20G23DW*
M025	**TSX2AA0011**	**LINE CORD**
M026	TXF3A011DB2	ASSY. DAG GROUND
M027	TKU2A22212M	COVER, CABINET BACK *CT–20R15W CT–20R15CW*
M028	TXFKU0897SER	ASSY. CABINET BACK 20" *CT–20G13W CT–20G13DW*
M029	TXFKU0997SER	ASSY, CABINET BACK 20" *CT–20G23W CT–20G23DW*
M030	TXFKU1096SER	ASSY, CABINET BACK 20" *CT–20G33W*
M031	TXFKY0197SER	ASSY, CABINET FRONT 20" *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
M032	TXFKY0297SER	ASSY, CABINET FRONT 20" *CT–20R15W CT–20R15CW*
M033	TXFKY1497SER	ASSY, CABINET FRONT 20" *CT–20G33W*
M034	0FMK014ZZ	CONVERGENCE CORRECTOR STRIP
DEG	**0LK19042A**	**COIL, DEGAUSSING 20"**
DY	**0LY15312F1**	**YOKE, DEFLECTION** ***CT–20G33W*** ***CT–20G13W CT–20G13DW*** ***CT–20G23W CT–20G23DW***
DY	**TLY2AA001**	**YOKE, DEFLECTION** ***CT–20R15W CT–20R15CW***
JK3001	TJB2A9061B	BRKT. A/V *CT–20R15W CT–20R15CW*
JK3001	TJB2A9063B	ASSY. JACK 1A/V *CT–20G33W* *CT–20G23W CT–20G23DW*
JK3001	TJB2A9064B	ASSY. JACK A/V *CT–20G13W CT–20G13DW*
JK3002	TJB2AA0031	TERMINAL, A/V *CT–20G13W CT–20G13DW* *CT–20G23W CT–20G23DW*
JK3002	TJB2AA0032	TERMINAL, A/V *CT–20R15W CT–20R15CW*
J214	EXCELSA24T	FERRITE BEAD
J241	EXCELSA24T	FERRITE BEAD

Notes

SERVICEMAN MODE (ELECTRONIC CONTROL)
SERVICE ADJUSTMENT VALUES

Model ______________________ Ser # ____________ Date ____________

Note: Record the original settings PRIOR to modifying the registers.

Mode	Service Adjustment	Adjustment Range	Def Val.	Original Value	New Value
Sub Adjustments					
B0	Sub Color	0 ~ 63	33		
B1	Sub Tint	0 ~ 63	33		
B2	Sub Brightness	0 ~ 255	80		
B3	Sub Contrast	0 ~ 63	34		
B4	Killer/ABL/Gamma	0 ~ 7	5		
B5	Video Adjustment	0 ~ 15	8		
B6	Audio Adjustment	0 ~ 31	16		
B7	V–Size	0 ~ 63	20		
White Balance Adjustments					
C0	RED Cutoff	*	0 128		
C1	GRN Cutoff	0 ~ 255	64		
C2	BLU Cutoff	*	0 128		
C3	R Drive	0 ~ 127	64		
C4	Blue Drive	0 ~ 127	64		
C5	YNR Switch	0 ~ 1	0		
C6	AFT	*	1 120		
C7	RF AGC	0 ~ 255	192		
C8	YNR	0 ~ 7	0		
C9	Horizontal–Center	0 ~ 31	16		
Ca	Beam Limit	0 ~ 7	0		
Cb	Y Delay	0 ~ 2	2		

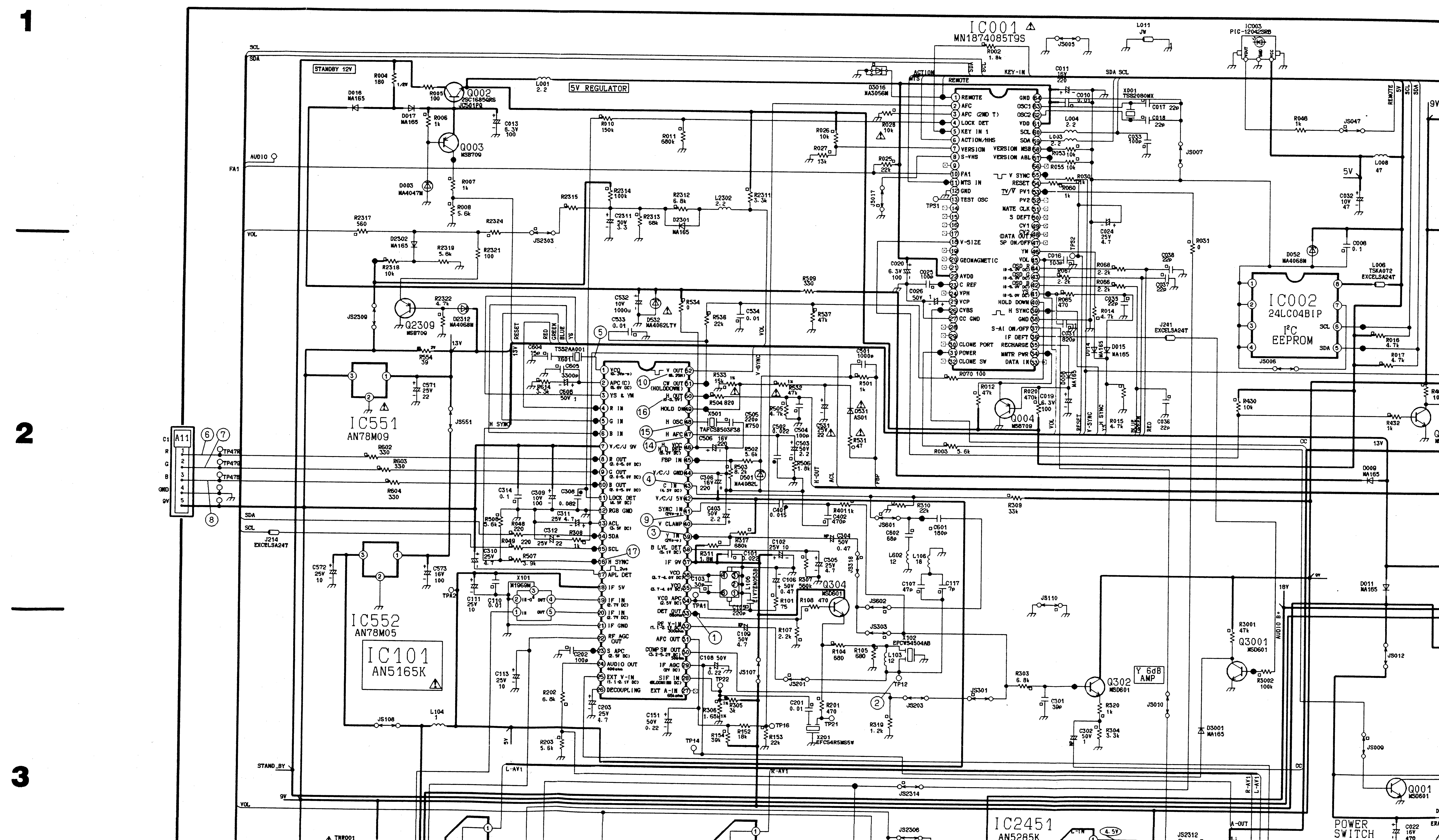
* Adjustment indicated in steps:
0 0 ~ 0 255
1 0 ~ 1 255

** Set Freerun on when this item is selected.

Mode	Service Adjustment	Adjustment Range	Def. Val.	Original Value	New Value
Options Adjustments					
S0	PIP Color	0 ~ 127	51		
S1	PIP Contrast	0 ~ 127	47		
S2	Up 1/9	0 ~ 255	25		
S3	Down 1/9	0 ~ 255	146		
S4	Left 1/9	0 ~ 255	11		
S5	Right 1/9	0 ~ 255	104		
S6	Up 1/16	0 ~ 255	25		
S7	Down 1/16	0 ~ 255	163		
S8	Left 1/16	0 ~ 255	11		
S9	Right 1/16	0 ~ 255	119		
Sa	Freerun	0 ~ 15	0		
Sb	Clock Adjustment	0 ~ 255	–		
Sc	Pip Tint	0 ~ 63	224		
Sd	Loudness Compensation	0 ~ 63	52		
Se	PIP Brightness	0 ~ 31	14		
Sf	Gate Adjust	0 ~ 31	15		
MTS Adjustments					
M0	Input Level	0 ~ 127	31		
M1	Stereo PLLVCO	0 ~ 127	31		
M2	Filter	0 ~ 255	31		
M3	Low–level Separation	0 ~ 255	31		
M4	High–level Separation	0 ~ 255	31		

Printed in USA
V98012800JM0120

A–Board Schem
Model CT–20G3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R
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9V
SCL
SDA
AUDIO
FA1
VOL
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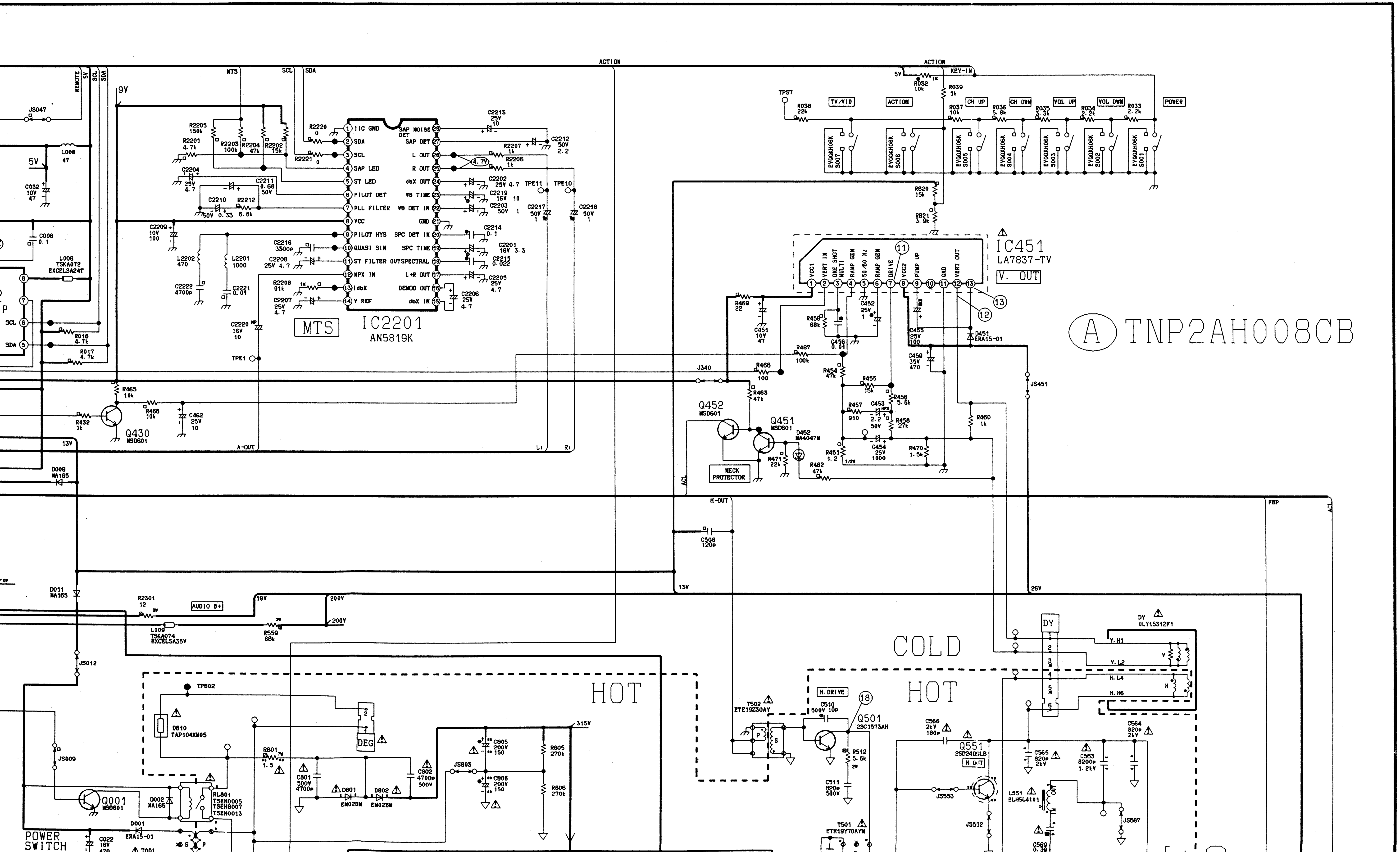
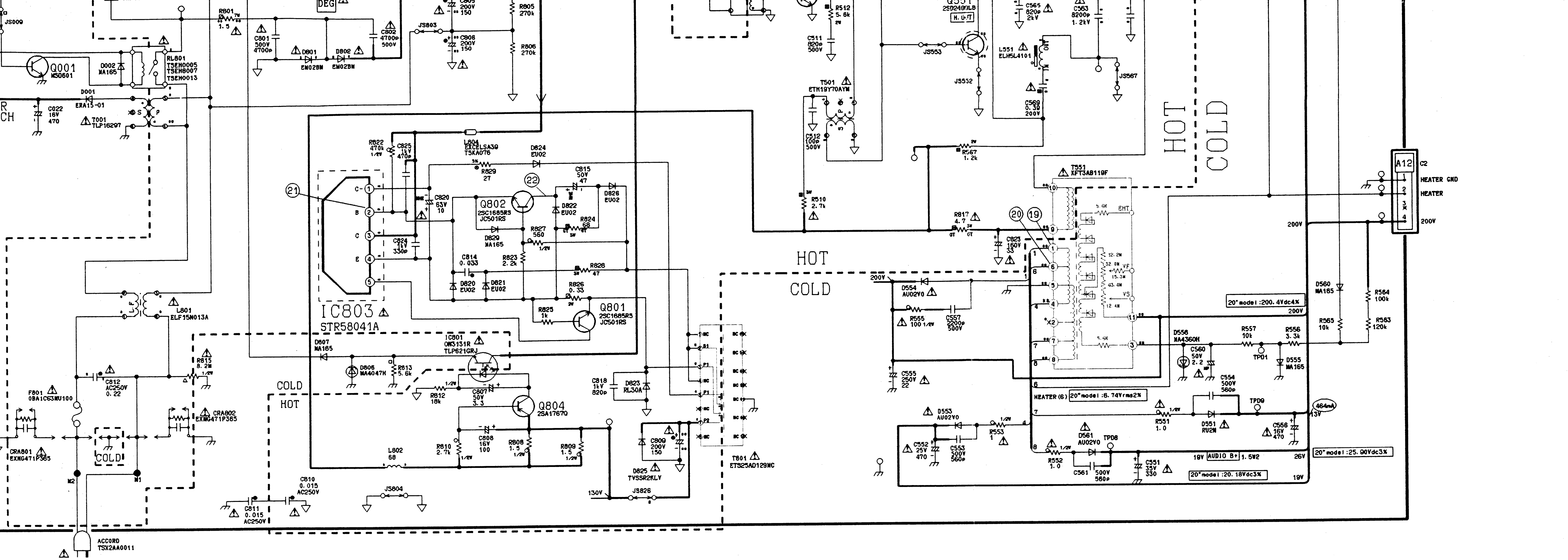
H SYNC
RESET
RED
GREEN
BLUE
YS
V-SYNC
H-OUT
ACL
FBP
13V
18V
AUDIO B+
CC
L-AV1
R-AV1
A-OUT
POWER SWITCH
TNR001
REMOTE
ACTION
KEY-IN
TP47R
TP47G
TP47B
TP12
TP14
TP16
TP21
TP22
TPA1
TPA2
TPS1
TPS2
J214
EXCELSA24T
J241
EXCELSA24T
L006
TSKA072
EXCELSA24T
JS108
JS551
JS2309
JS2303
JS2306
JS2312
JS2314
JS601
JS602
JS303
JS301
JS201
JS203
JS107
JS110
JS012
JS009
JS010
JS005
JS006
JS007
JS047
JS017

E F G H

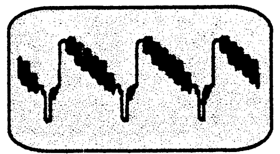
oard Schematic
el CT-20G33W

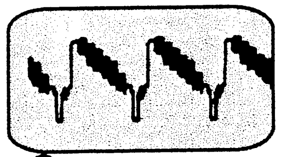


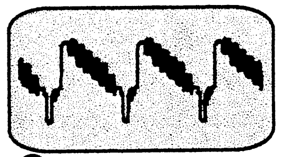
ACTION
MTS
SCL
SDA
REMOTE
5V
9V
JS047
L008 47
C032 10V 47
C006 0.1
L006 TSKA072 EXCELSA24T
R016 4.7k
R017 4.7k
R2205 150k
R2201 4.7k
R2203 100k
R2204 47k
R2202 15k
R2220 0
R2221 0
C2204 25V 4.7
C2211 0.68 50V
C2210 50V 0.33
R2212 6.8k
C2209 10V 100
L2202 470
L2201 1000
C2222 4700p
C2221 0.01
C2216 3300p
C2208 25V 4.7
R2208 91k
C2207 25V 4.7
C2220 16V 10
TPE1
IIC GND
SDA
SCL
SAP LED
ST LED
PILOT DET
PLL FILTER
VCC
PILOT HYS
QUASI SIN
ST FILTER OUT
MPX IN
dbX
V REF
SAP NOISE DET
SAP DET
L OUT
R OUT
dbX OUT
WB TIME
WB DET IN
GND
SPC DET IN
SPC TIME
SPECTRAL
L+R OUT
DEMOD OUT
dbX IN
MTS
IC2201
AN5819K
C2213 25V 10
C2212 50V 2.2
R2207 1k
R2206 1k
4.7V
C2202 25V 4.7
C2219 16V 10
C2203 50V 1
TPE11
TPE10
C2217 50V 1
C2218 50V 1
C2214 0.1
C2201 16V 3.3
C2215 0.022
C2205 25V 4.7
C2206 25V 4.7
R465 10k
R466 10k
R432 1k
Q430 MSD601
C462 25V 10
A-OUT
L1
R1
13V
D009 MA165
D011 MA165
R2301 12
AUDIO B+
L009 TSKA074 EXCELSA35V
19V
200V
R550 68k
JS012
JS009
Q001 MSD601
D002 MA165
RL801 TSEH0005 TSEH8007 TSEH0013
D001 ERA15-01
C022 16V 470
T001
POWER SWITCH
TP802
D810 TAP104XM05
DEG
HOT
R801 1.5
C801 500V 4700p
D801 EM02BM
D802 EM02BM
C802 4700p 500V
JS803
C805 200V 150
C806 200V 150
R805 270k
R806 270k
315V
5V
ACTION
KEY-IN
R032 10k
R039 1k
TPS7
R038 22k
TV/VID
ACTION
CH UP
CH DWN
VOL UP
VOL DWN
POWER
R037 10k
R036 5.6k
R035 3.3k
R034 2.2k
R033 2.2k
EVQQXH06K S007
EVQQXH06K S006
EVQQXH06K S005
EVQQXH06K S004
EVQQXH06K S003
EVQQXH06K S002
EVQQXH06K S001
R820 15k
R821 3.9k
IC451
LA7837-TV
V. OUT
VCC1
VERT IN
ONE SHOT MULTI
RAMP GEN
50/60 Hz
RAMP GEN
DRIVE
VCC2
PUMP UP
GND
VERT OUT
11
12
13
R469 22
C451 10V 47
C452 25V 1
R459 68k
C456 0.01
C455 25V 100
D451 ERA15-01
C450 35V 470
R467 100k
R468 100
J340
R454 47k
R463 47k
R455 15k
R456 5.6k
R457 910
C453 2.2 50V
R458 27k
C454 25V 1000
R470 1.5k
R451 1.2
R460 1k
JS451
Q452 MSD601
Q451 MSD601
D452 MA4047M
NECK PROTECTOR
R471 22k
R482 47k
ACL
H-OUT
C508 120p
FBP
13V
26V
A TNP2AH008CB
COLD
HOT
DY
DY 0LY15312F1
V.H1
V.L2
H.L4
H.H6
T502 ETE19Z30AY
H.DRIVE
C510 500V 10p
18
Q501 2SC1573AH
R512 5.6k
C511 820p 500V
C566 2kV 180p
Q551 2SD2499LB
H.OUT
JS553
JS552
L551 ELH5L4101
C565 820p 2kV
C563 8200p 1.2kV
C564 820p 2kV
JS567
C569 0.39
T501 ETH19Y70AYM

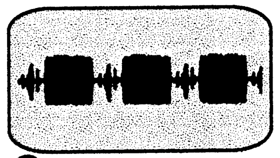

IC803
STR58041A
IC801 ON3131R TLP621GRJ
Q801 2SC1685RS JC501RS
Q802 2SC1685RS JC501RS
Q804 2SA1767Q
Q001 M5060I
RL801 TSEH0005 TSEH0007 TSEH0013
T001 TLP16297
L801 ELF15N013A
F801 0BA1C63MU100
CRA801 EXNG471P365
CRA802 EXNG471P365
L804 EXCELSA39 TSKA076
L802 68
D825 TVSSR2KLY
T801 ETS25AD129NC
T551 XFT3AB119F
T501 ETH19Y70AYM
L551 ELH5L4101
A12
HEATER GND
HEATER
200V
HEATER (6) 20" model :6.74Vrms2%
20" model :200.4Vdc4%
20" model :25.90Vdc3%
20" model :20.18Vdc3%
AUDIO B+
19V
26V
130V
464mA
EHT
VF
VS
HOT
COLD
ACCORD TSX2AA0011
DEG
JS009
JS803
JS804
JS826
JS553
JS552
JS567

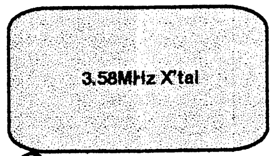
Waveforms – A-Board


① 2.04V p-p [20µs]

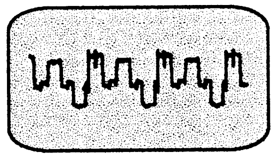

② 0.98V p-p [20µs]
TP12

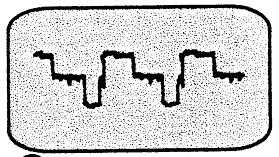

③ 2.00V p-p [20µs]
IC101 PIN 39 (Y IN)

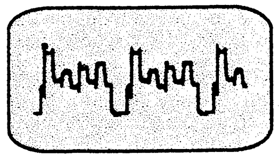

④ 11.30V p-p [20µs]
IC101 PIN 43 (C IN)

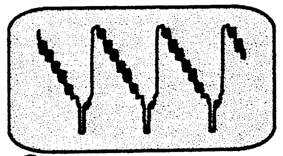


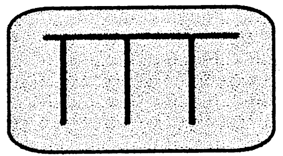
⑤ IC101 PIN 1
3.58VCO
OSC Waveform

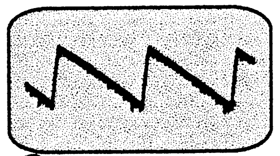

⑥ 5.60V p-p [20µs]
A11 PIN 1 (R)
TP47R

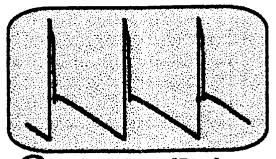

⑦ 4.36V p-p [20µs]
A11 PIN 2 (G)
TP47G

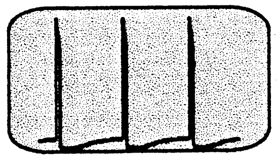

⑧ 4.60V p-p [20µs]
A11 PIN 3 (B)
TP47B

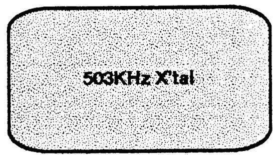

⑨ 1.82V p-p [20µs]
IC101 PIN 41 (SYNC)


⑩ 5.20V p-p [5ms]
IC101 PIN 52 (VERT OUT)

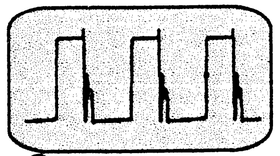

⑪ 1.52V p-p [5ms]
IC451 PIN 7 (DRIVE)

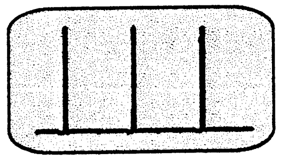

⑫ 59.60V p-p [5ms]
IC451 PIN 12 (VERT OUT)

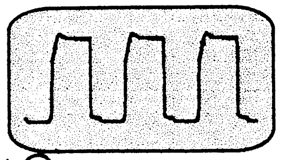

⑬ 34.00V p-p [5ms]
IC451 PIN 13

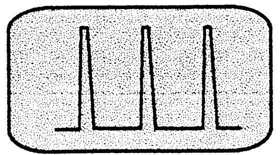


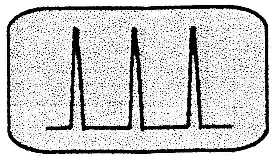
⑮ IC101 PIN 48
H OSC
OSC Waveform

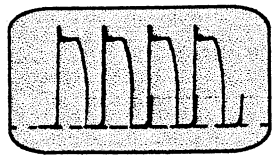

⑯ 4.44V p-p [20µs]
IC101 PIN 50 (H OUT)

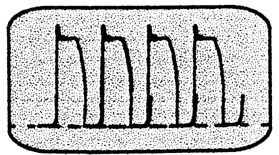

⑰ 8.80V p-p [20µs]
IC101 PIN 16 (H SYNC)


⏚ ⑱ 246.00V p-p [20µs]
Q501 collector (H DRIVE)


⑲ 324.00V p-p [20µs]
T551 PIN 1


⑳ 28.80V p-p [20µs]
T551 PIN 6


⏚ ㉑ 398.00V p-p [5µs]
IC803 PIN 2

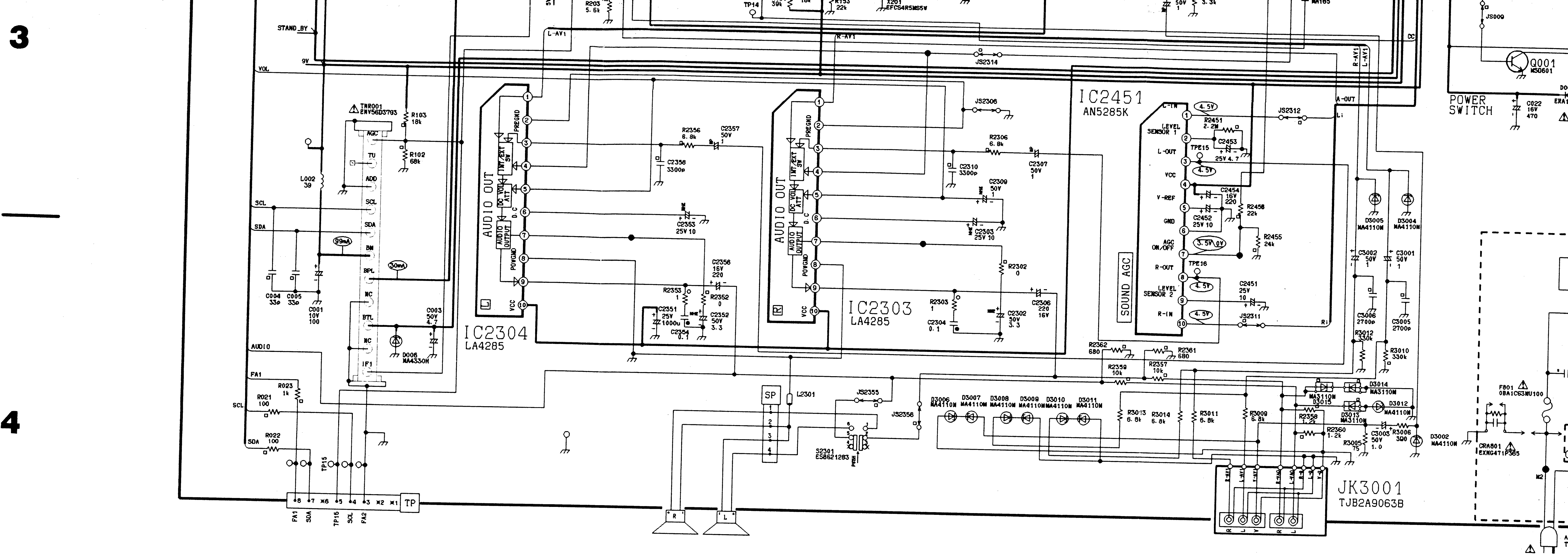

⏚ ㉒ 398.00V p-p [5µs]
Collector of Q802

easurements

Audio Mode – Stereo
- Voltage readings are nominal and may vary ±10% on active devices. Some voltage reading will vary with signal strength and picture content.
- Supply voltages are all nominal.

2. Ground symbol ⏚ indicates ground lead connection of meter. **Caution: Incorrect ground connection will result in erroneous readings.**

CJ, Audio Out
ve


3
4
5
STAND_BY
VOL
9V
TNR001
ENV56D3703
AGC
TU
ADD
SCL
SDA
BM
BPL
NC
BTL
IF1
R103 18k
R102 68k
L002 39
C004 33p
C005 33p
C001 10V 100
C003 50V 4.7
D006 MA4330H
AUDIO
FA1
R023 1k
R021 100
R022 100
TP15
TP
FA1 SDA TP15 SCL FA2
L-AV1
R-AV1
AUDIO OUT
PREGND
INT/EXT SW
DC VOL ATT
AUDIO OUTPUT
POWGND
VCC
IC2304
LA4285
IC2303
LA4285
R2356 6.8k
C2357 50V 1
C2358 3300p
C2353 25V 10
C2356 16V 220
R2353 1
R2352 0
C2351 25V 1000u
C2354 0.1
C2352 50V 3.3
JS2306
JS2314
R2306 6.8k
C2307 50V 1
C2310 3300p
C2309 50V 1
C2303 25V 10
R2302 0
C2306 220 16V
R2303 1
C2304 0.1
C2302 50V 3.3
IC2451
AN5285K
SOUND AGC
L-IN
LEVEL SENSOR 1
L-OUT
VCC
V-REF
GND
AGC ON/OFF
R-OUT
LEVEL SENSOR 2
R-IN
4.5V
3.5V 0V
TPE15
TPE16
R2451 2.2M
C2453 25V 4.7
C2454 16V 220
C2452 25V 10
R2458 22k
R2455 24k
C2451 25V 10
JS2312
JS2311
A-OUT
R-AV1
L-AV1
CC
D3005 MA4110H
D3004 MA4110H
C3002 50V 1
C3001 50V 1
C3006 2700p
C3005 2700p
R3012 330k
R3010 330k
R2362 680
R2361 680
R2359 10k
R2357 10k
SP
L2301
JS2355
JS2356
S2301 ES8621283
D3006 MA4110H
D3007 MA4110H
D3008 MA4110H
D3009 MA4110H
D3010 MA4110H
D3011 MA4110H
R3013 6.8k
R3014 6.8k
R3011 6.8k
R3009 6.8k
D3014 MA3110H
D3015 MA3110H
D3012 MA4110H
D3013 MA3110H
R2358 1.2k
R2360 1.2k
R3005 75
C3003 50V 1.0
R3006 390
D3002 MA4110H
JK3001
TJB2A9063B
R L V R L
R L
POWER SWITCH
Q001 MS0601
C022 16V 470
JS009
F801 0BA1C63MU100
CRA801 EXNG471P365
M2
TP14
R203 5.6k
EFCS4R5MS5W

Waveform Measurements

1. ③ indicates waveform measurement. (Measurement can be taken at the best accessible location in common to the indicated point.)
2. Taken with a NTSC signal generator connected to the antenna terminal. (NTSC color bar pattern of 8 bars of EIA colors, 100 IRE white and 7.5 IRE black.)
3. Customer Controls (Picture/Audio Menu) are set to Normalize. Volume is set to "MIN".
4. All video and color waveforms are taken with a wideband scope and a probe with low capacitance (10 to 1). Shape and peak amplitudes may vary depending on the type of Oscilloscope used and its settings.
5. Ground symbol ⏚ shown on waveform number indicates (Hot) ground lead connection of the Oscilloscope. **CAUTION:** Incorrect ground connection of the test equipment will result in erroneous readings.

The waveforms are taken in the order of circuit flow through the various sections as follows:

VIDEO – Waveforms 1~3
COLOR – Waveforms 4~8
VERTICAL – Waveforms 10~13
HORIZONTAL – Waveforms 16~17
CRT DRIVE – Waveforms 18~20
POWER SUPPLY – Waveforms 21~22

Schematic Notes

1. Resistors are carbon 1/4W unless noted otherwise.
2. Capacitors are ceramic 50V unless noted otherwise.
3. Coil value noted is inductance in µH.
4. Test point indicated by ●. Test point but no pin ○.
5. Components indicated with ⚠ are critical parts and replacement should be made with manufacture specified replacement parts only.
6. ▬ **(BOLD LINE)** Indicates the route of B+ supply.
7. The schematic diagrams are current at the time of printing and are subject to change without notice.
8. Ground symbol ⏚ indicates **HOT GROUND CONNECTION;** ⏚ indicates COLD GROUND.

NOTE: All other component symbols are used for engineering design purposes.

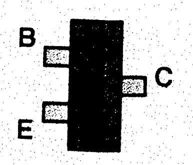
Voltage Measureme

1. Voltage measurement:
   - AC input to the Receiver is 120V. NTSC generator is connected to the antenna of the Receiver. (Color bar pattern of 100IRE white and 7.5 IRE black.)
   - All Picture and Audio adjustments are set to Normalize.
     TV ANT/CABLE – (Set–Up Menu) in TV/ANT Mode
     Volume – Min
     TV/Video SW – TV position
     Audio Mod
   - Voltage re
     may vary
     Some volt
     signal stre
   - Supply vol
2. Ground symb
   lead connectio
   Caution:
   connection w
   readings.

IMPORTANT SAFETY NOTICE

THIS SCHEMATIC DIAGRAM INCORPORATES SPECIAL FEATURES THAT ARE IMPORTANT FOR PROTECTION FROM X-RADIATION, FIRE AND ELECTRICAL SHOCK HAZARDS. WHEN SERVICING IT IS ESSENTIAL THAT ONLY MANUFACTURERS SPECIFIED PARTS BE USED FOR THE CRITICAL COMPONENTS DESIGNATED WITH A ⚠ IN THE SCHEMATIC.

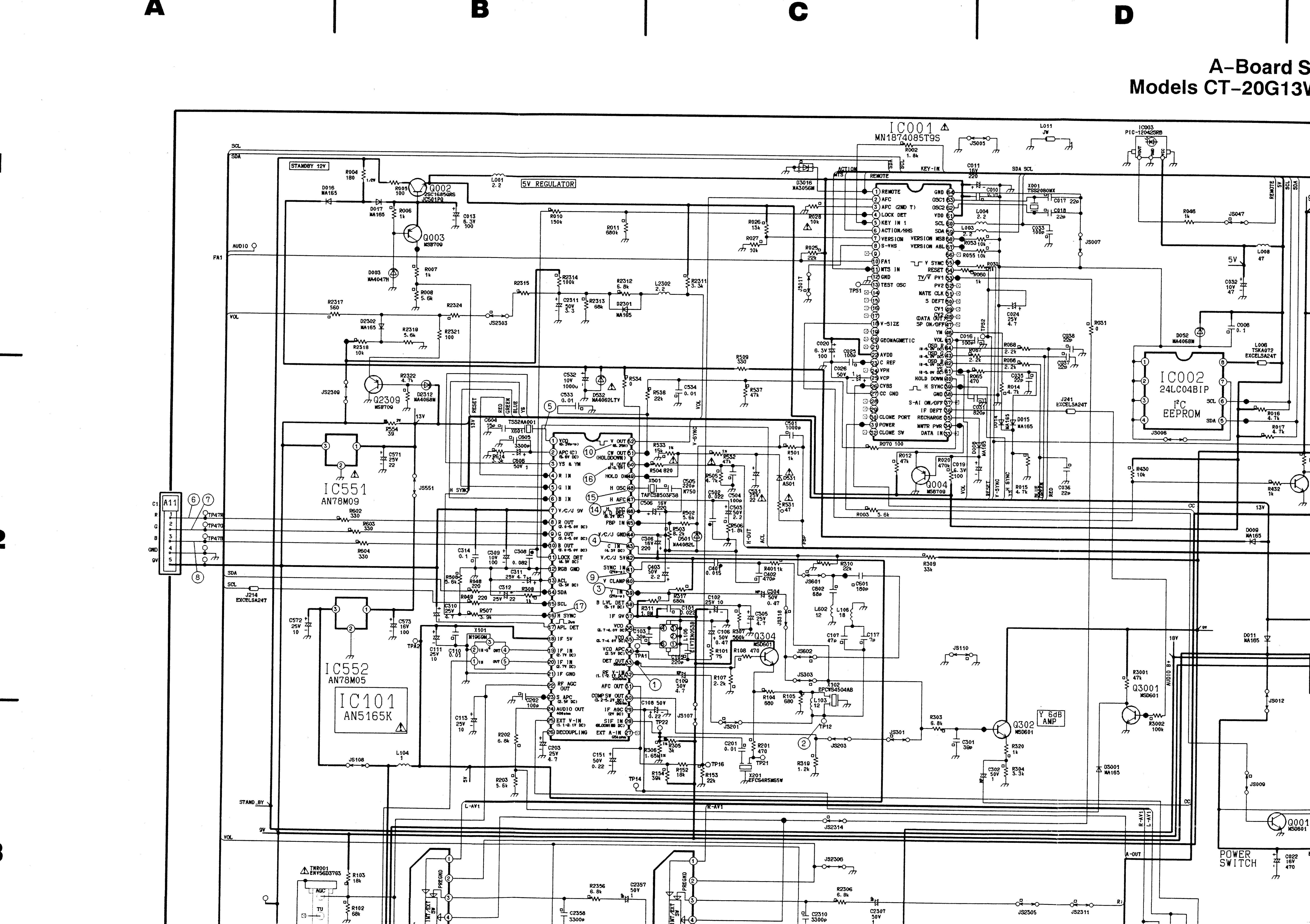
CHIP TRANSISTOR LEAD DESIGNATION



Board Index

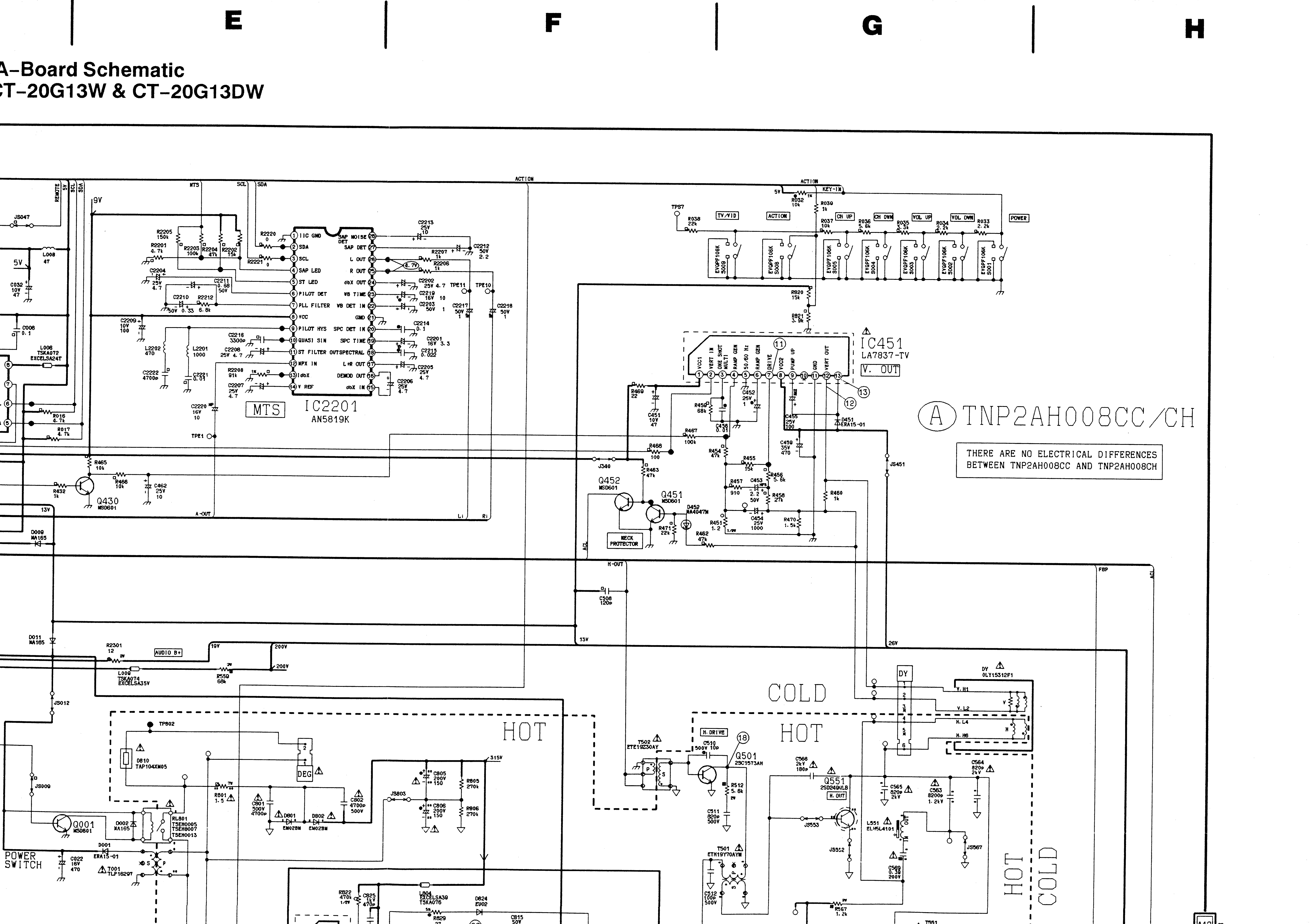
A – **Board** – MPU, VCJ, Audio Out
C – **Board** – CRT Drive

A–Board S
Models CT-20G13V



A
B
C
D
IC001
MN1874085T9S
IC002
24LC04BIP
I²C EEPROM
IC003
PIC-1204ZSRB
IC101
AN5165K
IC551
AN78M09
IC552
AN78M05
Q001
Q002
2SC1685QRS
Q003
MSB709
Q004
MSB709
Q2309
MSB709
Q302
MSD601
Y 6dB AMP
Q304
MSD601
Q3001
MSD601
STANDBY 12V
5V REGULATOR
POWER SWITCH
A11
SCL
SDA
AUDIO
FA1
VOL
STAND_BY
9V
R
G
B
GND
L-AV1
R-AV1
A-OUT
AUDIO B+
TNR001
ENV56D37G3
X101
M1969M
X501
TAFCSB503F38
X102
EFCWS4504AB
X201
EFCS4R5MS5W
X001
TSS2080MX
X601
TSS2AA001
L001
L008
L006
TSKA072
EXCELSA24T
J214
EXCELSA24T
J241
EXCELSA24T
REMOTE
AFC
AFC (2ND T)
LOCK DET
KEY IN 1
ACTION/HHS
VERSION
S-VHS
FA1
MTS IN
GND
TEST OSC
V-SIZE
GEOMAGNETIC
AVDD
C REF
VPH
VCP
CVBS
CC GND
CLONE PORT
POWER
CLONE SW
GND
OSC1
OSC2
VDD
SCL
SDA
VERSION MSB
VERSION ABL
V SYNC
RESET
TV/V PV1
PV2
MATE CLK
S DEFT
CV1
CV2
DATA OUT
SP ON/OFF
YM
VOL
OSD R
OSD G
OSD B
OSD I
HOLD DOWN
H SYNC
GND
S-AI ON/OFF
IF DEFT
RECHARGE
MNTR PWR
DATA IN
VCO
APC (C)
YS & YM
R IN
G IN
B IN
V/C/J 9V
R OUT
G OUT
B OUT
LOCK DET
RGB GND
ACL
SDA
SCL
H SYNC
APL DET
IF 5V
IF IN
IF GND
RF AGC OUT
S APC
AUDIO OUT
EXT V-IN
DECOUPLING
V OUT
CW OUT (HOLDDOWN)
H OUT
HOLD DWN
H OSC
H AFC
H VCC
FBP IN
V/C/J GND
C IN
V/C/J 5V
SYNC IN
V CLAMP
Y IN
B LVL DET
IF 9V
VCO
VCO APC
DET OUT
PE V-IN
AFC OUT
COMP SW OUT
IF AGC
SIF IN
EXT A-IN
JS108
JS551
JS2309
JS2303
JS5005
JS047
JS007
JS006
JS601
JS318
JS602
JS303
JS110
JS107
JS201
JS203
JS301
JS012
JS009
JS2314
JS2306
JS2305
JS2311
TPA1
TPA2
TP12
TP14
TP16
TP21
TP22
TPS1
TPS2
TP47R
TP47G
TP47B
PREGND
AGC
TU

A–Board Schematic
CT–20G13W & CT–20G13DW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F
G
H
IC2201
AN5819K
MTS
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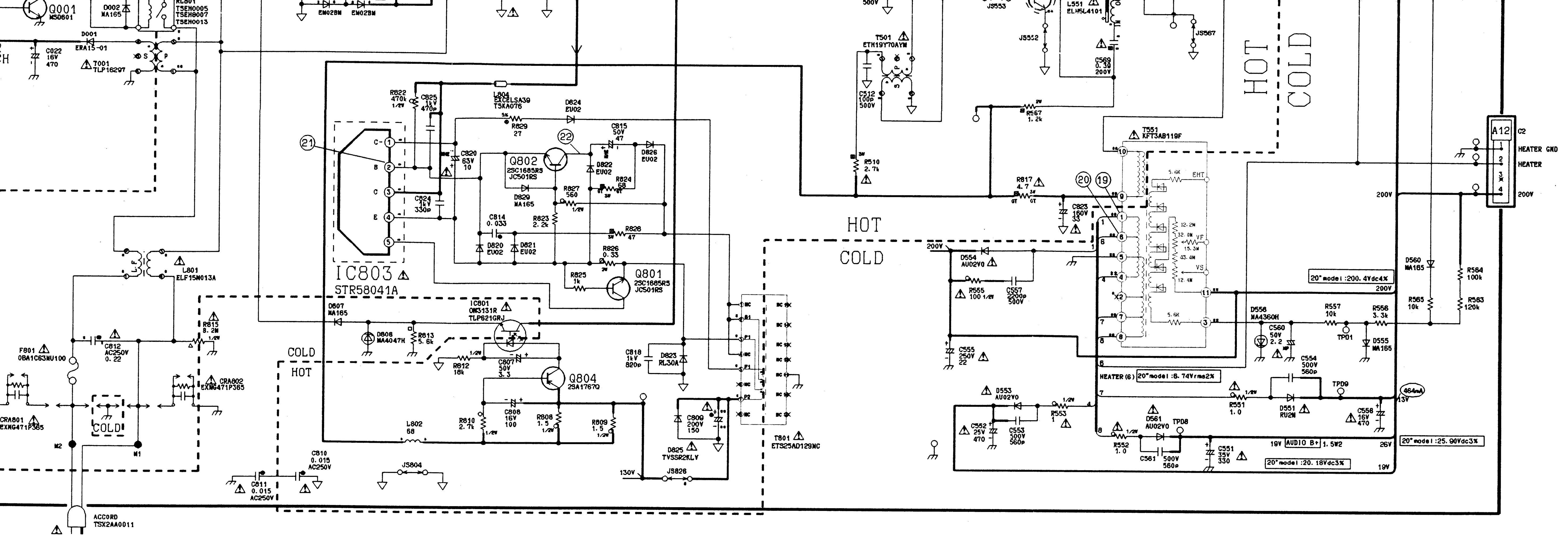
SDA
SCL
SAP LED
ST LED
PILOT DET
PLL FILTER
VCC
PILOT HYS
QUASI SIN
ST FILTER
MPX IN
I dbX
V REF
SAP NOISE DET
SAP DET
L OUT
R OUT
dbX OUT
WB TIME
WB DET IN
GND
SPC DET IN
SPC TIME
OUTSPECTRAL
L+R OUT
DEMOD OUT
dbX IN
ACTION
KEY-IN
TV/VID
CH UP
CH DWN
VOL UP
VOL DWN
POWER
IC451
LA7837-TV
V. OUT
VCC1
VERT IN
ONE SHOT MULTI
RAMP GEN
50/60 Hz
DRIVE
VCC2
PUMP UP
VERT OUT
Q452 MSD601
Q451 MSD601
NECK PROTECTOR
Q430 MSD601
Q001 MSD601
Q501 2SC1573AH
Q551 2SD2499LB
H. OUT
H. DRIVE
T502 ETE19Z30AY
T501 ETH19Y70AYM
T001 TLP16297
RL801 TSEH0005 TSEH0007 TSEH0013
D810 TAP104XM05
DEG
DY 0LY15312F1
L551 ELH5L4101
AUDIO B+
POWER SWITCH
HOT
COLD
(A) TNP2AH008CC/CH
THERE ARE NO ELECTRICAL DIFFERENCES
BETWEEN TNP2AH008CC AND TNP2AH008CH


Q001
MS0601
D002
MA165
RL801
TSEH0005
TSEH8007
TSEH0013
EM02BM
EM02BM
D001
ERA15-01
C022
16V
470
T001
TLP16297
S
P
L801
ELF15N013A
F801
0BA1C63NU100
C812
AC250V
0.22
R815
8.2M
CRA802
EXNG471P365
CRA801
EXNG471P365
COLD
M2
M1
ACCORD
TSX2AA0011
R822
470k
1/2W
C825
1kV
470p
L804
EXCELSA39
TSKA076
D824
EU02
R829
27
C815
50V
47
D826
EU02
21
22
C-
B
C
E
1
2
3
4
5
C820
63V
10
Q802
2SC1685RS
JC501RS
D822
EU02
R824
68
C824
1kV
330p
D829
MA165
R827
560
R823
2.2k
C814
0.033
R828
47
D820
EU02
D821
EU02
R826
0.33
R825
1k
Q801
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JC501RS
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D807
MA165
IC801
ON3131R
TLP621GRJ
D808
MA4047H
R813
5.6k
COLD
HOT
R812
18k
C807
50V
3.3
Q804
2SA1767Q
C818
1kV
820p
D823
RL30A
L802
68
R810
2.7k
C808
16V
100
R808
1.5
R809
1.5
C809
200V
150
D825
TVSSR2KLV
C810
0.015
AC250V
C811
0.015
AC250V
JS804
130V
JS826
T801
ETS25AD129NC
500V
JS553
L551
ELH5L4101
T501
ETH19Y70AYM
JS552
C569
0.39
200V
JS567
C512
100p
500V
R567
1.2k
R510
2.7k
HOT
COLD
T551
KFT3AB119F
20
19
R817
4.7
C823
160V
33
HOT
COLD
EHT
5.6K
12.2M
32.0M
VF
15.3M
43.4M
VS
12.4M
5.6K
200V
D554
AU02V0
R555
100 1/2W
C557
2200p
500V
C555
250V
22
HEATER (6)
20"model :6.74Vrms2%
20"model :200.4Vdc4%
200V
D556
MA4360H
C560
50V
2.2
R557
10k
TPD1
R556
3.3k
D555
MA165
C554
500V
560p
TPD9
464mA
13V
D553
AU02V0
R553
1
C552
25V
470
C553
500V
560p
R551
1.0
D551
RU2N
C558
16V
470
R552
1.0
D561
AU02V0
TPD8
C561
500V
560p
C551
35V
330
19V
AUDIO B+
1.5W2
26V
20"model :25.90Vdc3%
20"model :20.18Vdc3%
19V
A12
C2
HEATER GND
HEATER
200V
200V
D560
MA165
R564
100k
R565
10k
R563
120k

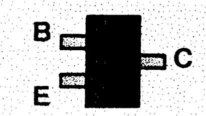
”-Board

IC2201			
01	0.00	15	3.89
02	4.33	16	4.50
03	4.38	17	4.52
04	2.21	18	4.51
05	7.86	19	0.46
06	4.57	20	4.49
07	2.75	21	0.00
08	8.95	22	4.35
09	4.40	23	0.45
10	4.52	24	4.45
11	4.50	25	4.51
12	4.40	26	4.51
13	3.04	27	4.58
14	4.51	28	5.07

	Q001	Q002	Q003	Q004	Q302	Q304	Q430	Q451
B	0.72	5.81	4.93	5.10	28.30	2.71	0.23	0.64
C	0.07	10.04	5.78	0.00	8.94	8.94	5.27	0.02
E	0.00	5.12	5.81	5.08	2.23	2.10	0.00	0.02

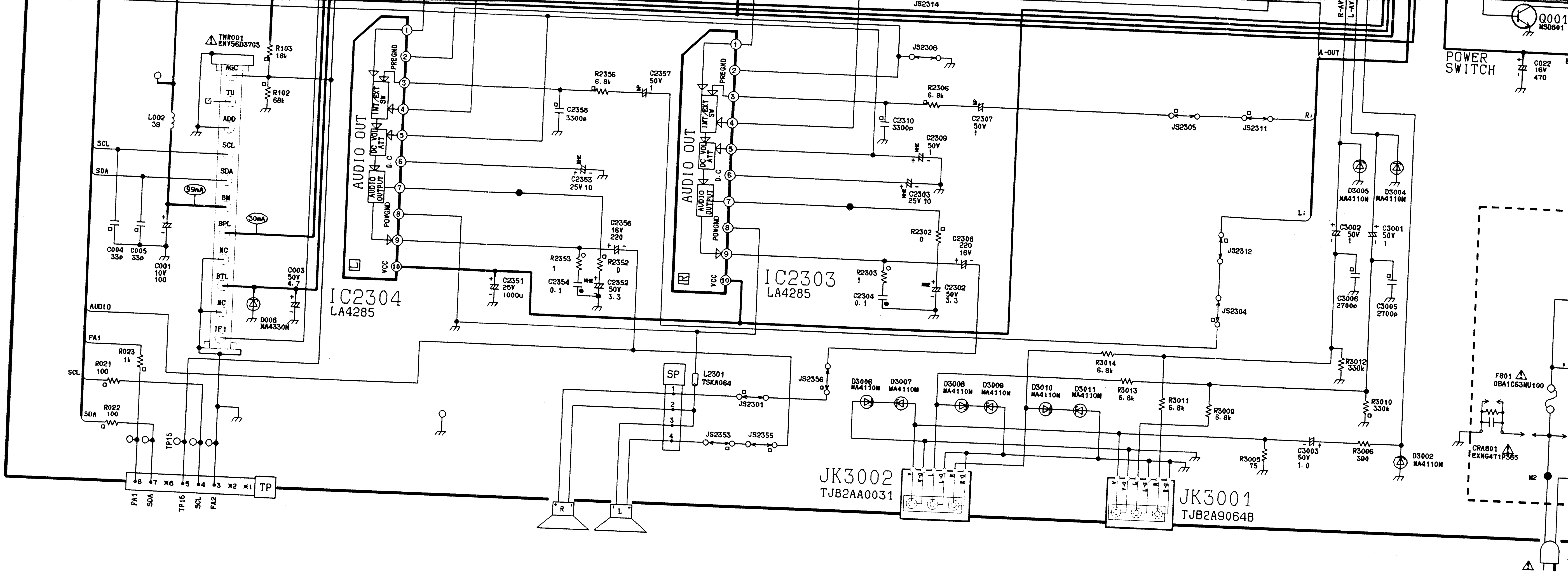
	Q452	Q501 ⏚	Q551 ⏚	Q801 ⏚	Q802 ⏚	Q804 ⏚	Q2309	Q3001
B	0.02	0.00	−0.07	132.50	133.10	132.90	0.97	0.00
C	3.51	102.70	137.60	135.70	133.50	0.56	0.00	8.90
E	0.02	0.00	0.00	133.00	133.20	133.20	0.98	0.00

CHIP TRANSISTOR LEAD DESIGNATION



IMPORTANT SAFETY NOTICE

THIS SCHEMATIC DIAGRAM INCORPORATES SPECIAL FEATURES THAT ARE IMPORTANT FOR PROTECTION FROM X-RADIATION, FIRE AND ELECTRICAL SHOCK HAZARDS. WHEN SERVICING IT IS ESSENTIAL THAT ONLY MANUFACTURERS SPECIFIED PARTS BE USED FOR THE CRITICAL COMPONENTS DESIGNATED WITH A ⚠ IN THE SCHEMATIC.


JS2314
TNR001 ENV56D37G3
R103 18k
R102 68k
AGC
TU
ADD
SCL
SDA
BM
BPL
NC
BTL
NC
IF1
L002 39
99mA
30mA
C004 33p
C005 33p
C001 10V 100
C003 50V 4.7
D006 MA4330H
AUDIO
FA1
R023 1k
R021 100
R022 100
SCL
SDA
TP15
TP16
AUDIO OUT
PREGND
INT/EXT SW
DC VOL ATT
D.C
AUDIO OUTPUT
POWGND
VCC
IC2304
LA4285
R2356 6.8k
C2357 50V 1
C2358 3300p
C2353 25V 10
C2356 16V 220
R2353 1
R2352 0
C2354 0.1
C2352 50V 3.3
C2351 25V 1000u
IC2303
LA4285
JS2306
R2306 6.8k
C2307 50V 1
C2310 3300p
C2309 50V 1
C2303 25V 10
R2302 0
C2306 220 16V
R2303 1
C2304 0.1
C2302 50V 3.3
JS2305
JS2311
JS2312
JS2304
JS2356
SP
L2301 TSKA064
JS2301
JS2353
JS2355
D3006 MA4110M
D3007 MA4110M
D3008 MA4110M
D3009 MA4110M
D3010 MA4110M
D3011 MA4110M
R3014 6.8k
R3013 6.8k
R3011 6.8k
R3009 6.8k
R3012 330k
R3010 330k
R3005 75
C3003 50V 1.0
R3006 390
D3002 MA4110M
D3005 MA4110M
D3004 MA4110M
C3002 50V 1
C3001 50V 1
C3006 2700p
C3005 2700p
A-OUT
R-AV
L-AV
Ri
Li
POWER SWITCH
C022 16V 470
Q001 M5801
F801 0BA1C63MU100
CRA801 EXNG471P385
M2
JK3002
TJB2AA0031
JK3001
TJB2A9064B
TP
FA1
SDA
TP16
SCL
FA2
R
L

Voltage Measurements “A”-Boar

IC001			
01	5.09	33	0.00
02	2.44	34	5.09
03	0.39	35	5.12
04	3.47	36	0.00
05	5.11	37	0.00
06	2.55	38	0.00
07	0.94	39	0.16
08	0.00	40	4.13
09	0.00	41	0.00
10	5.11	42	0.00
11	0.30	43	0.00
12	0.00	44	0.00
13	2.56	45	0.28
14	0.00	46	0.00
15	0.00	47	0.00
16	0.00	48	0.00
17	0.00	49	0.00
18	0.32	50	0.00
19	0.00	51	0.00
20	0.00	52	0.00
21	0.00	53	0.00
22	5.11	54	5.25
23	0.06	55	4.16
24	1.90	56	0.00
25	1.33	57	0.00
26	1.75	58	0.00
27	0.00	59	4.89
28	0.00	60	4.90
29	0.00	61	5.12
30	0.00	62	2.51
31	5.07	63	2.27
32	0.00	64	0.00

IC101			
01	2.74	27	4.43
02	5.64	28	3.18
03	0.00	29	2.69
04	0.00	30	2.80
05	0.00	31	4.37
06	0.00	32	2.00
07	8.94	33	2.71
08	3.21	34	2.60
09	3.27	35	3.46
10	3.25	36	0.00
11	4.27	37	8.94
12	0.00	38	4.00
13	3.52	39	4.11
14	4.87	40	2.90
15	4.87	41	4.14
16	0.29	42	5.00
17	3.33	43	3.48
18	5.00	44	0.00
19	2.76	45	0.45
20	2.76	46	6.13
21	0.00	47	4.11
22	4.47	48	2.21
23	4.94	49	5.61
24	4.22	50	0.89
25	1.72	51	6.29
26	5.58	52	4.10

IC2303	
01	6.30
02	0.00
03	6.31
04	0.00
05	0.97
06	9.45
07	9.52
08	0.00
09	9.61
10	20.27

IC2304	
01	6.31
02	0.00
03	6.33
04	0.00
05	0.68
06	8.90
07	9.00
08	0.00
09	9.05
10	19.08

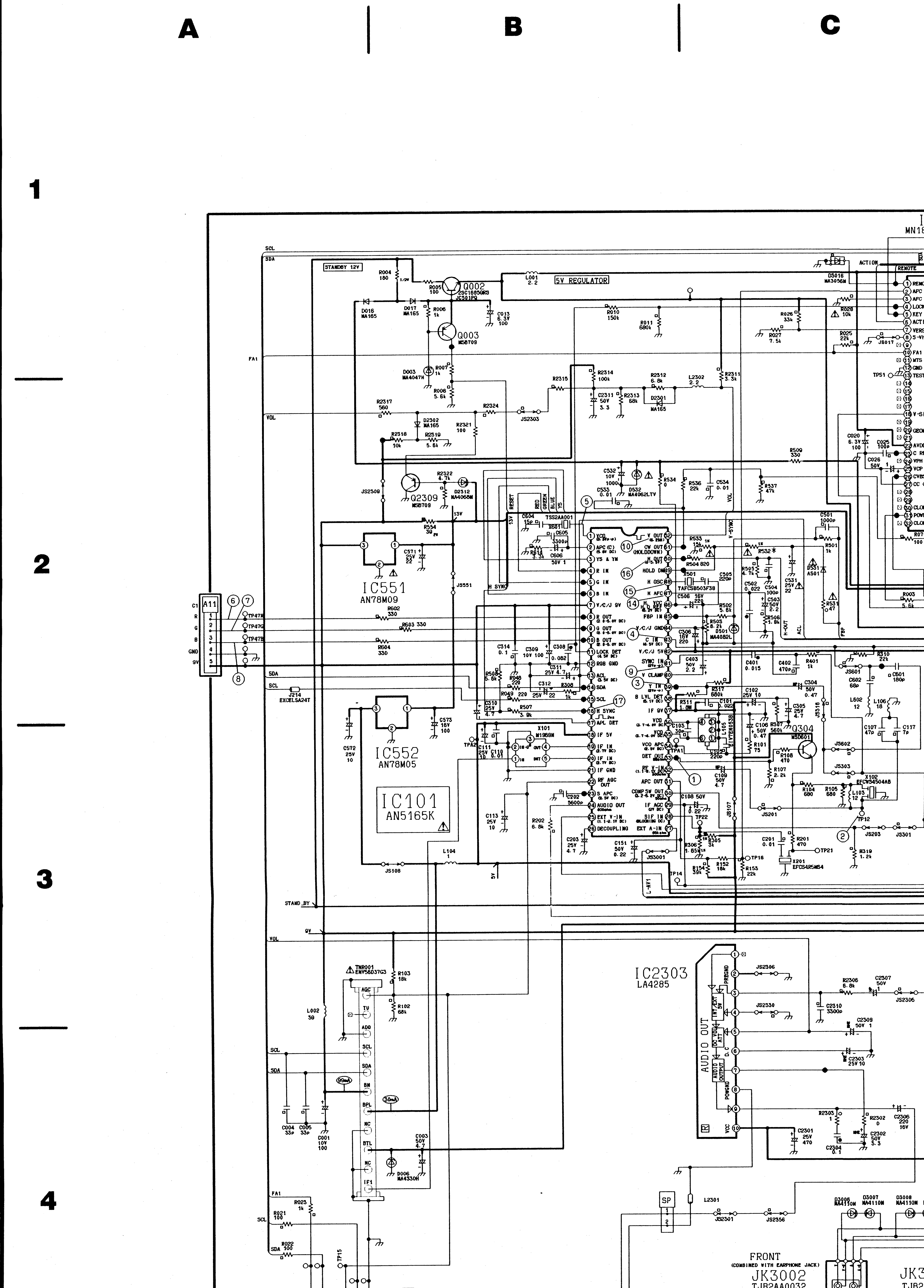
IC451	
01	8.84
02	4.16
03	4.41
04	4.50
05	0.02
06	4.32
07	4.27
08	24.44
09	1.82
10	1.35
11	0.02
12	13.49
13	24.90

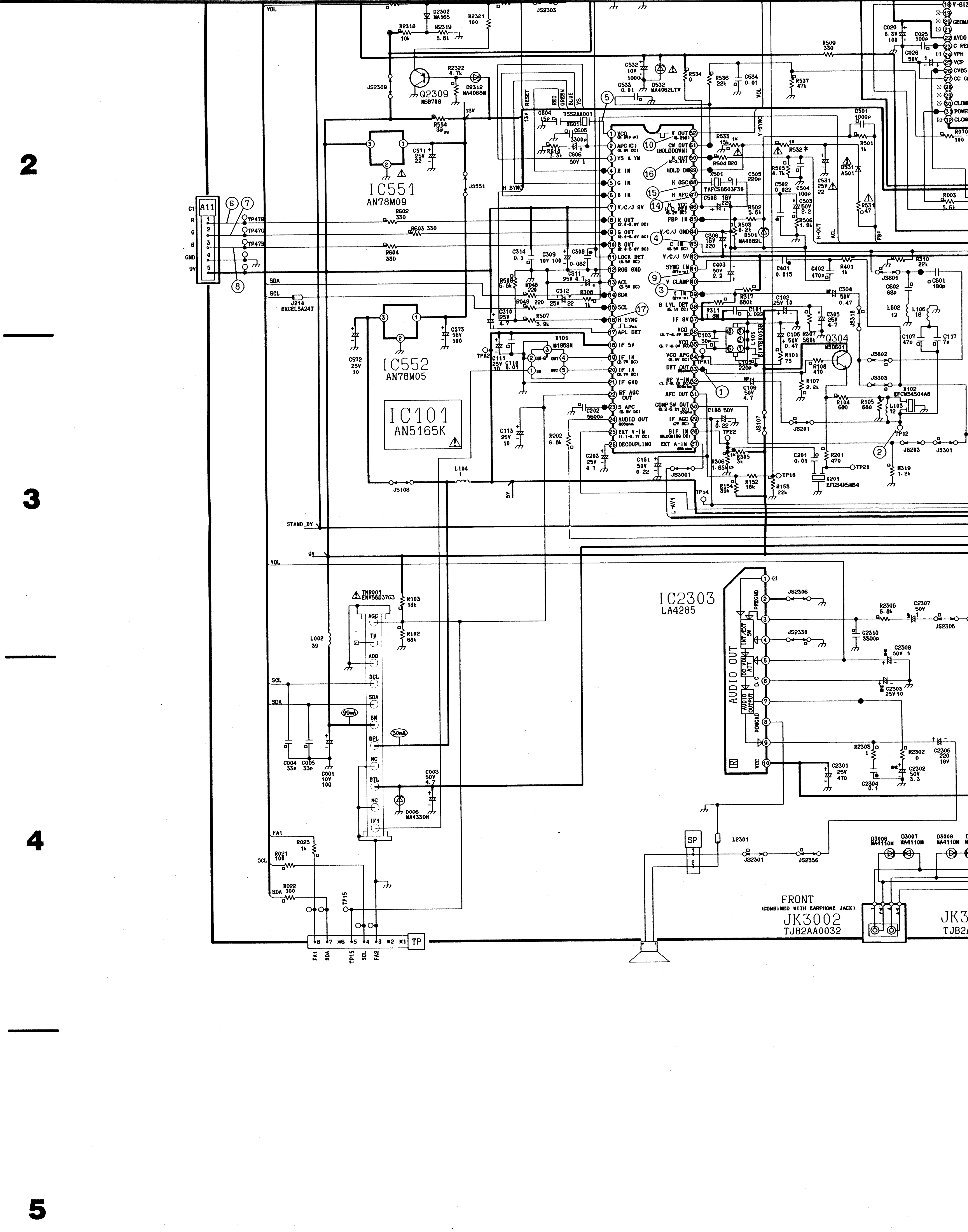
IC002	
01	0.00
02	0.00
03	0.00
04	0.00
05	4.87
06	4.87
07	0.00
08	5.12

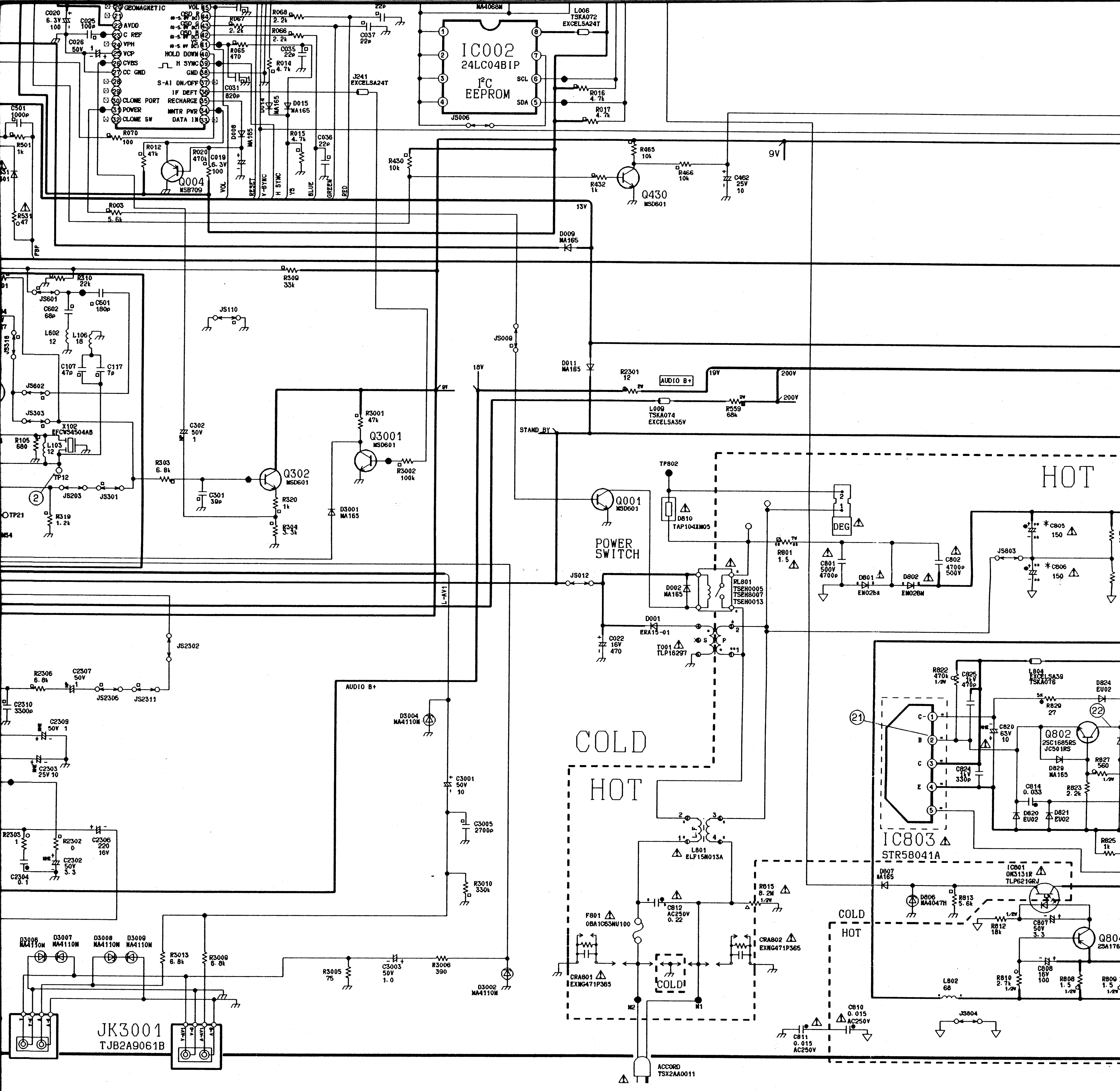
IC803 ⏚	
01	90.4
02	133.2
03	305.7
04	133.1
05	135.2

IC2451	
01	4.47
02	1.10
03	4.49
04	8.94
05	4.48
06	0.00
07	0.00
08	4.49
09	2.00
10	4.47

01	
02	
03	
04	
05	
06	
07	
08	
09	
10	
11	
12	
13	
14	

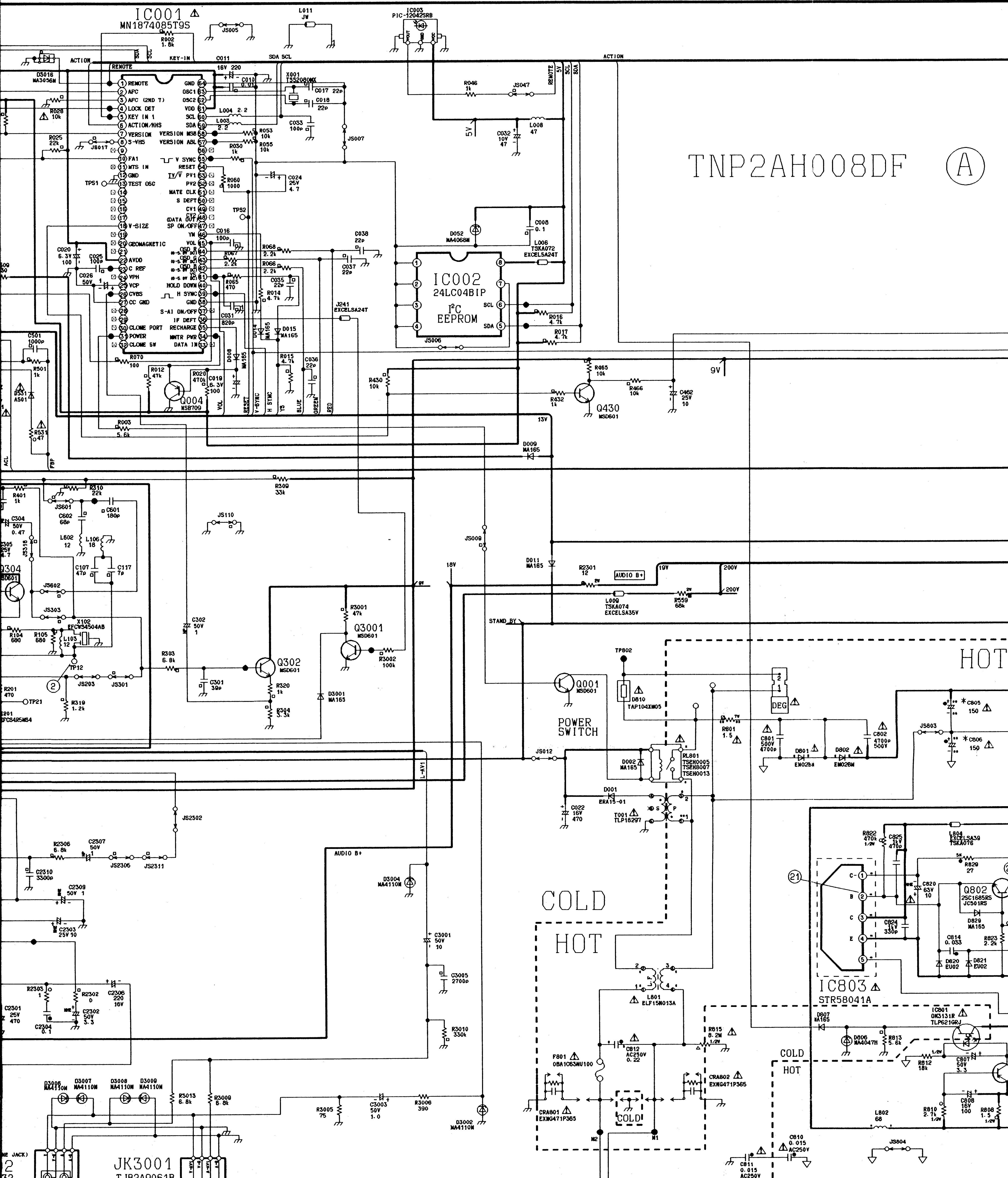

A
B
C
1
2
3
4
STANDBY 12V
5V REGULATOR
Q002 2SC1685GRS JC501PQ
Q003 MSB709
Q2309 MSB709
D016 MA165
D017 MA165
D003 MA4047H
D2302 MA165
D2312 MA4068M
D2301 MA165
D532 MA4062LTV
D501 MA4082L
D3016 MA3056M
IC551 AN78M09
IC552 AN78M05
IC101 AN5165K
X501 TSS2AA001
X101 M1959M
Q304 MSD601
X102 EFCW54504AB
X201 EFCS4R5MS4
A11
TP47R
TP47G
TP47B
C1 R G B GND 9V
SCL
SDA
FA1
VOL
STAND_BY
9V
J214 EXCELSA24T
TNR001 ENV56D37G3
AGC TU ADD SCL SDA BM BPL NC BTL NC IF1
90mA
30mA
D006 MA4330H
IC2303 LA4285
AUDIO OUT
INT/EXT SW
DC VOL ATT
AUDIO OUTPUT
PRE GND
POW GND
VCC
SP
L2301
JS2301
JS2356
FRONT (COMBINED WITH EARPHONE JACK)
JK3002
TJB2AA0032
D3006 MA4110M
D3007 MA4110M
D3008 MA4110M
ACTION
REMOTE
VCO
APC (C)
YS & YM
R IN
G IN
B IN
V/C/J 9V
R OUT
G OUT
B OUT
LOCK DET
RGB GND
ACL
SDA
SCL
H SYNC
APL DET
IF 5V
IF IN
IF IN
IF GND
RF AGC OUT
S APC
AUDIO OUT
EXT V-IN
DECOUPLING
V OUT
CW OUT (HOLDDOWN)
H OUT
HOLD DWN
H OSC
H AFC
H. VCC
FBP IN
V/C/J GND
C IN
V/C/J 5V
SYNC IN
V CLAMP
Y IN
B LVL DET
IF 9V
VCO
VCO
VCO APC
DET OUT
RF V-IN
AFC OUT
COMP SW OUT
IF AGC
SIF IN
EXT A-IN
RESET
RED
GREEN
BLUE
YS
V-SYNC
H-OUT
ACL
FBP
L-AV1
MN18

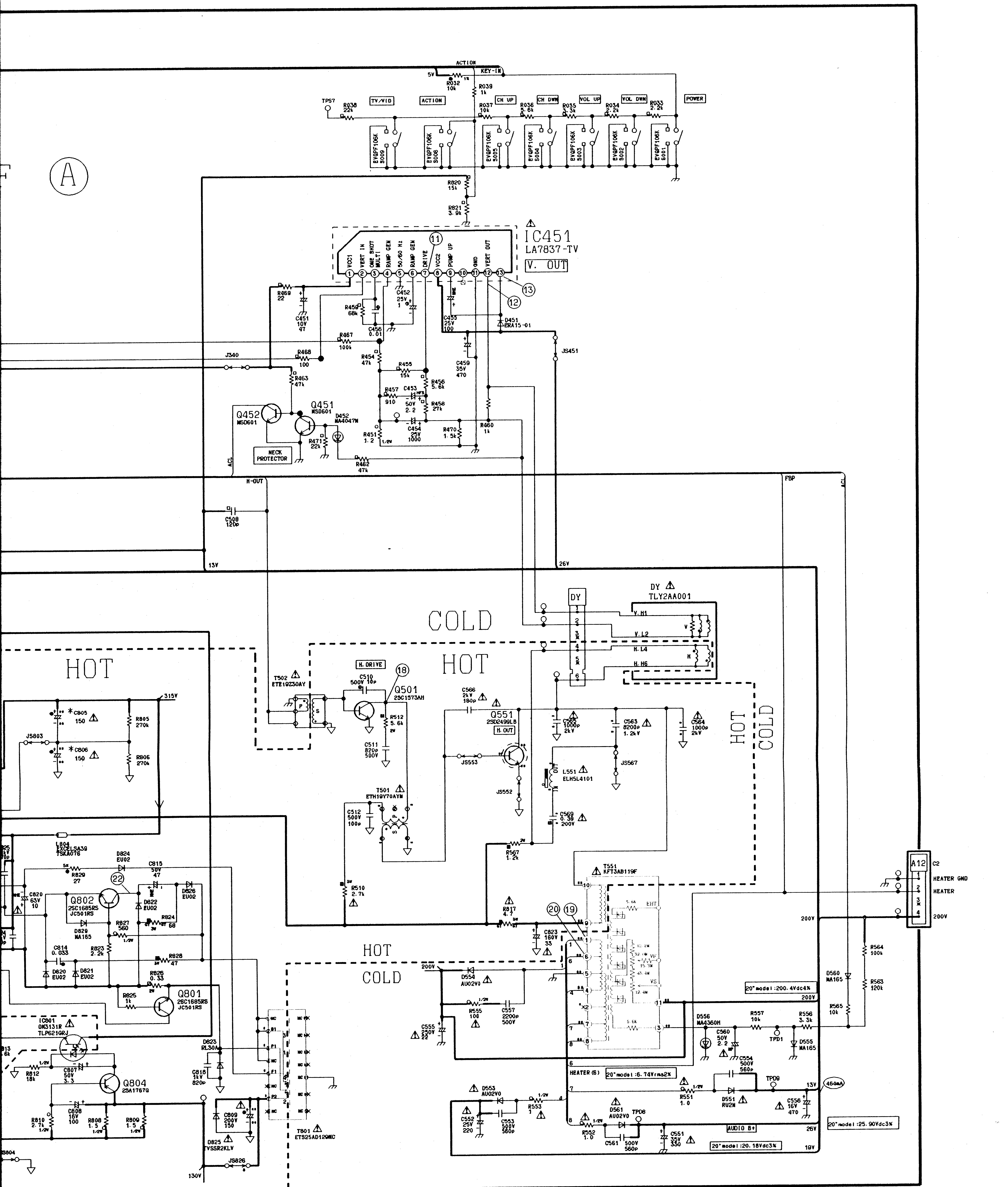

2
3
4
5
IC551
AN78M09
IC552
AN78M05
IC101
AN5165K
IC2303
LA4285
AUDIO OUT
A11
TP47R
TP47G
TP47B
GND
9V
R602 330
R603 330
R604 330
SDA
SCL
J214 EXCEL5A24T
STAND_BY
VOL
9V
Q2309 MSB709
D2302 MA165
D2312 MA4068M
R2318 10k
R2319 5.6k
R2321 100
R2322 4.7k
R554 39
13V
JS2303
JS2309
JS551
C571 25V 22
C572 25V 10
C573 16V 100
JS108
L104 1
5V
TNR001 ENV56D37G3
AGC
TV
ADD
SCL
SDA
BM
BPL
NC
BTL
NC
IF1
R103 18k
R102 68k
L002 39
C004 33p
C005 33p
C001 10V 100
C003 50V 4.7
D006 MA4330H
99mA
50mA
FA1
R025 1k
R021 100
R022 100
TP15
FA1
SDA
TP15
SCL
FA2
TP
VCO
APC (C)
YS & YM
R IN
G IN
B IN
V/C/J 9V
R OUT
G OUT
B OUT
LOCK DET
RGB GND
ACL
SDA
SCL
H SYNC
APL DET
IF 5V
IF IN
IF IN
IF GND
RF AGC OUT
S APC
AUDIO OUT
EXT V-IN
DECOUPLING
V OUT
CW OUT (HOLDDOWN)
H OUT
HOLD DWN
H OSC
H AFC
H VCC
FBP IN
V/C/J GND
C IN
V/C/J 5V
SYNC IN
V CLAMP
Y IN
B LVL DET
IF 9V
VCO
VCO
VCO APC
DET OUT
PE V-IN
AFC OUT
COMP SW OUT
IF AGC
SIF IN
EXT A-IN
RESET
RED
GREEN
BLUE
YS
H SYNC
V-SYNC
VOL
C604 15p
TSS2AA001
X601
C605 3300p
R614 3.3k
C606 50V 1
C532 10V 1000
D532 MA4062LTV
C533 0.01
R534 0
R536 22k
C534 0.01
R537 47k
R509 330
R533 15k
R532
R504 820
X501
TAFCSB503F38
C505 220p
C506 16V 220
R502 5.6k
R503 8.2k
D501 MA4082L
C306 16V 220
C403 50V 2.2
R317 680k
R311 1.8M
C101 0.022
C102 25V 10
C103 30p
L105
TPA1
C105 220p
C106 50V 0.47
R307 560k
Q304 MSD601
R101 75
R108 470
R107 2.2k
C109 50V 4.7
C108 50V 0.22
TP22
R306 1.65M
R305 3k
R152 18k
R154 39k
R153 22k
TP16
TP14
C151 50V 0.22
JS3001
L-AV1
JS107
C201 0.01
R201 470
TP21
X201 EFCS4R5MS4
R319 1.2k
JS201
JS203
JS301
TP12
R104 680
R105 680
L103 12
X102 EFCV54504AB
JS303
JS602
JS601
C602 68p
L602 12
L106 18
C107 47p
C117 7p
C601 180p
R310 22k
C401 0.015
C402 470p
R401 1k
C304 50V 0.47
C305 25V 4.7
JS318
C501 1000p
R501 1k
D531 A501
R531 47
C531 25V 22
R505 4.7k
C502 0.022
C504 100p
C503 50V 2.2
R506 3.9k
H-OUT
ACL
FBP
R003 5.6k
R070 100
C020 6.3V 100
C025 100p
C026 50V 1
V-SY
GEOM
AVDD
C RE
VPH
VCP
CVBS
CC G
CLOM
POWE
CLOM
C314 0.1
C309 10V 100
C308 0.082
C311 25V 4.7
C312 25V 22
R308 1k
R049 220
R048 220
R508 5.6k
C310 25V 4.7
R507 3.9k
X101 M1969N
TPA2
C111 25V 10
C110 0.01
C113 25V 10
C202 5600p
R202 6.8k
C203 25V 4.7
JS2306
JS2330
R2306 6.8k
C2307 50V 1
JS2305
C2310 3300p
C2309 50V 1
C2303 25V 10
PREGND
INT/EXT SW
DC VOL ATT
D.C
AUDIO OUTPUT
POWGND
VCC
R2303 1
R2302 0
C2306 220 16V
C2302 50V 3.3
C2301 25V 470
C2304 0.1
SP
L2301
JS2301
JS2356
FRONT
(COMBINED WITH EARPHONE JACK)
JK3002
TJB2AA0032
D3006 MA4110N
D3007 MA4110N
D3008 MA4110N
JK3
TJB2

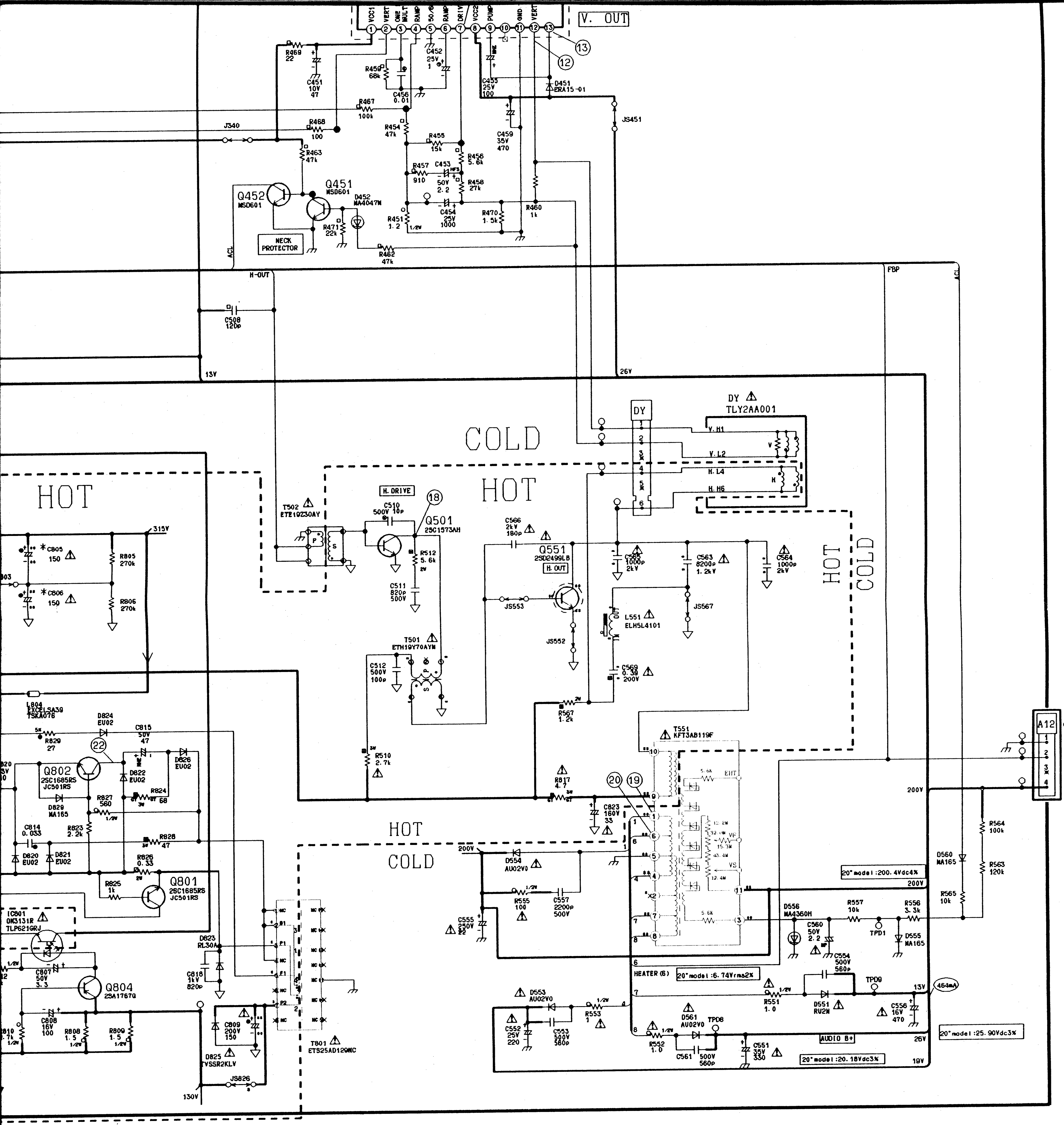


IC002
24LC04BIP
I²C
EEPROM
SCL
SDA
J5006
L006
TSKA072
EXCELSA24T
MA4068M
GEOMAGNETIC
AVDD
C REF
VPH
VCP
CVBS
CC GND
CLONE PORT
POWER
CLONE SW
VOL
OSD R
OSD G
OSD B
HOLD DOWN
H SYNC
GND
S-A1 ON/OFF
IF DEFT
RECHARGE
MNTR PWR
DATA IN
Q004
MSB709
RESET
V-SYNC
H SYNC
Y5
BLUE
GREEN
RED
J241
EXCELSA24T
R430
10k
R465
10k
R466
10k
R432
1k
Q430
MSD601
C462
25V
10
9V
13V
D009
MA165
R309
33k
JS110
JS009
18V
D011
MA165
R2301
12
AUDIO B+
19V
200V
200V
L009
TSKA074
EXCELSA35V
R559
68k
STAND_BY
R3001
47k
Q3001
MSD601
R3002
100k
Q302
MSD601
R303
6.8k
C302
50V
1
C301
39p
R320
1k
R304
3.3k
D3001
MA165
X102
EFCWS4504A8
L103
12
TP12
JS203
JS301
R319
1.2k
TP21
Q001
MSD601
POWER
SWITCH
JS012
TP802
D810
TAP104XM05
DEG
R801
1.5
C801
500V
4700p
D801
EM02BM
D802
EM02BM
C802
4700p
500V
HOT
J5803
C805
150
C806
150
RL801
TSE0005
TSE8007
TSEH0013
D002
MA165
D001
ERA15-01
C022
16V
470
T001
TLP16297
JS2302
R2306
6.8k
C2307
50V
1
JS2306
JS2311
C2310
3300p
C2309
50V 1
C2303
25V 10
AUDIO B+
D3004
MA4110M
C3001
50V
10
C3005
2700p
R3010
330k
R2303
R2302
0
C2302
50V
3.3
C2306
220
16V
C2304
0.1
COLD
HOT
L801
ELF15N013A
R815
8.2M
F801
0BA1C63NU100
C812
AC250V
0.22
CRA801
EXNG471P365
CRA802
EXNG471P365
COLD
M2
M1
ACCORD
TSX2AA0011
C810
0.015
AC250V
C811
0.015
AC250V
COLD
HOT
L802
68
JS804
R822
470k
C825
1kV
470p
L804
EXCELSA39
TSKA076
D824
EU02
R829
27
Q802
2SC1685RS
JC501RS
C820
63V
10
D829
MA165
R827
560
C824
1kV
330p
C814
0.033
R823
2.2k
D820
EU02
D821
EU02
R825
1k
IC803
STR58041A
IC801
ON3131R
TLP621GRJ
D807
MA165
D806
MA4047M
R813
5.6k
R812
18k
C807
50V
3.3
R810
2.7k
C808
16V
100
R808
1.5
R809
1.5
D3006
MA4110M
D3007
MA4110M
D3008
MA4110M
D3009
MA4110M
R3013
6.8k
R3009
6.8k
R3005
75
C3003
50V
1.0
R3006
390
D3002
MA4110M
JK3001
TJB2A9061B
R003
5.6k
R070
100
R012
47k
R020
470k
C019
6.3V
100
C501
1000p
R501
1k
R531
47
R310
22k
C601
180p
JS601
C602
68p
L602
12
L106
18
C107
47p
C117
7p
JS602
JS303
R105
680
R016
4.7k
R017
4.7k
R068
2.2k
R067
2.2k
R066
2.2k
R065
470
R014
4.7k
C035
22p
C037
22p
C031
820p
D015
MA165
R015
4.7k
C036
22p
C020
6.3V
100
C025
100p
C026
50V
21
22
2

Model CT-20R15W & CT-20R15DW


IC001
MN1874085T9S
IC003
PIC-12042SRB
TNP2AH008DF
Ⓐ
IC002
24LC04BIP
I²C
EEPROM
X001
TS52080MX
Q004
MSB709
Q430
MSD601
Q302
MSD601
Q3001
MSD601
Q001
MSD601
POWER
SWITCH
AUDIO B+
STAND BY
ACTION
REMOTE
KEY-IN
SDA SCL
5V
9V
13V
18V
19V
200V
HOT
COLD
DEG
D810
TAP104XM05
RL801
TSEH0005
TSEH8007
TSEH0013
T001
TLP18297
L801
ELF15N013A
F801
CRA801
EXNG471P365
CRA802
EXNG471P365
IC803
STR58041A
IC801
ON3131R
TLP621GRJ
Q802
2SC1685RS
JC501RS
L804
EXCELSA39
TSKA076
X102
EFCW54504AB
JK3001
TJB2A0061B
②
㉑

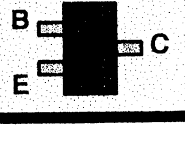

A
ACTION
KEY-IN
5V
R032 10k
R039 1k
TPS7
R038 22k
TV/VID
ACTION
CH UP
CH DWN
VOL UP
VOL DWN
POWER
R037 10k
R036 5.6k
R035 3.3k
R034 2.2k
R033 2.2k
EVQPF106K S006
EVQPF106K S008
EVQPF106K S005
EVQPF106K S004
EVQPF106K S003
EVQPF106K S002
EVQPF106K S001
R820 15k
R821 3.9k
IC451
LA7837-TV
V. OUT
VCC1
VERT IN
ONE SHOT MULTI
RAMP GEN
50/60 Hz
RAMP GEN
DRIVE
VCC2
PUMP UP
GND
VERT OUT
11
12
13
R469 22
C451 10V 47
R459 68k
C456 0.01
C452 25V 1
C455 25V 100
D451 ERA15-01
R467 100k
R468 100
J340
R454 47k
R455 15k
C459 35V 470
JS451
R463 47k
R457 910
C453 50V 2.2
R456 5.6k
R458 27k
Q452 MSD601
Q451 MSD601
D452 MA4047M
C454 25V 1000
R451 1.2
R470 1.5k
R460 1k
R471 22k
NECK PROTECTOR
R462 47k
ACL
H-OUT
FBP
ACL
C508 120p
13V
26V
DY
DY TLY2AA001
V.H1
V.L2
H.L4
H.H6
V
H
COLD
HOT
HOT
COLD
T502 ETE19Z30AY
H.DRIVE
C510 500V 10p
18
Q501 2SC1573AH
R512 5.6k
C511 820p 500V
C566 2kV 180p
Q551 2SD2499LB
H.OUT
C565 1000p 2kV
C563 8200p 1.2kV
C564 1000p 2kV
JS553
JS567
JS552
L551 ELH5L4101
C569 0.39 200V
T501 ETH19Y70AYN
C512 500V 100p
R567 1.2k
315V
C805 150
R805 270k
JS803
C806 150
R806 270k
L804 EXCELSA39 TSKA076
D824 EU02
R829 27
C815 50V 47
22
C820 63V 10
Q802 2SC1685RS JC501RS
D822 EU02
D826 EU02
D829 MA165
R827 560
R824 68
C814 0.033
R823 2.2k
R828 47
D820 EU02
D821 EU02
R826 0.33
R825 1k
Q801 2SC1685RS JC501RS
R510 2.7k
R817 4.7
C823 160V 33
20
19
T551 KFT3AB119F
EHT
VF
VS
HEATER (6)
20"model:6.74Vrms2%
A12
C2
HEATER GND
HEATER
200V
200V
R564 100k
R563 120k
D560 MA165
R565 10k
20"model:200.4Vdc4%
HOT
COLD
200V
D554 AU02V0
R555 100
C557 2200p 500V
C555 250V 22
D556 MA4360H
R557 10k
R556 3.3k
C560 50V 2.2
TPD1
D555 MA165
C554 500V 560p
IC801 ON3131R TLP621GRJ
R812 18k
C807 50V 3.3
Q804 2SA1767Q
D823 RL30A
C818 1kV 820p
C808 16V 100
R810 2.7k
R808 1.5
R809 1.5
C809 200V 150
D825 TVSSR2KLV
T801 ETS25AD120NC
JS804
JS826
130V
D553 AU02V0
R553 1
C552 25V 220
C553 500V 560p
TPD9
13V
464mA
R551 1.0
D551 RU2N
C556 16V 470
20"model:25.90Vdc3%
D561 AU02V0
TPD8
R552 1.0
C561 500V 560p
C551 35V 330
AUDIO 8+
26V
20"model:20.18Vdc3%
19V

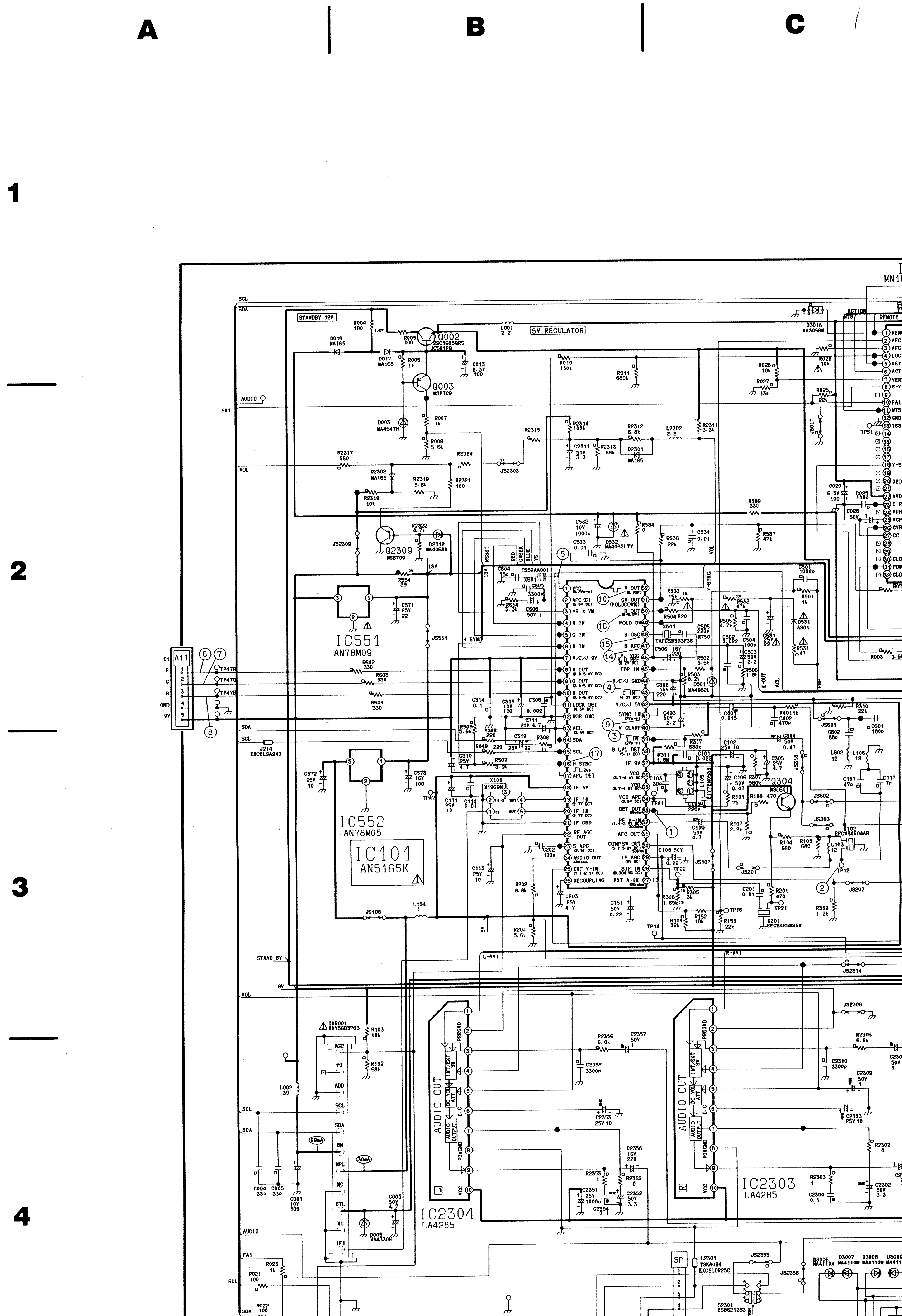

V. OUT
VCC1
VERT
ONE MULT
RAMP
50/60
RAMP
DRIVE
VCC2
PUMP
GND
VERT
(12)
(13)
R469 22
C451 10V 47
R459 68k
C452 25V 1
C456 0.01
C455 25V 100
D451 ERA15-01
R467 100k
R468 100
J340
JS451
R454 47k
R455 15k
R456 5.6k
C459 35V 470
R463 47k
R457 910
C453 50V 2.2
R458 27k
Q452 MSD601
Q451 MSD601
D452 MA4047M
R451 1.2
C454 25V 1000
R470 1.5k
R460 1k
R471 22k
NECK PROTECTOR
R462 47k
ACL
H-OUT
FBP
C508 120p
13V
26V
DY
DY TLY2AA001
COLD
V.H1
V.L2
H.L4
H.H6
HOT
HOT
HOT
COLD
H.DRIVE
(18)
C510 500V 10p
Q501 2SC1573AH
T502 ETE19Z30AY
315V
C805 150
R805 270k
C806 150
R806 270k
R512 5.6k
C511 820p 500V
C566 2kV 180p
Q551 2SD2499LB
H.OUT
C562 1000p 2kV
C563 8200p 1.2kV
C564 1000p 2kV
JS553
JS567
L551 ELH5L4101
JS552
T501 ETH19Y70AYN
C512 500V 100p
C569 0.39 200V
R567 1.2k
L804 EXCELSA39 TSKA076
D824 EU02
C815 50V 47
R829 27
(22)
Q802 2SC1685RS JC501RS
D826 EU02
D822 EU02
R824 68
D829 MA165
R827 560
R510 2.7k
T551 KFT3AB119F
EHT
R817 4.7
(20)
(19)
C823 160V 33
C814 0.033
R823 2.2k
R828 47
D620 EU02
D821 EU02
R826 0.33
R825 1k
Q801 2SC1685RS JC501RS
IC801 ON3131R TLP621GRJ
HOT
COLD
200V
D554 AU02V0
R555 100
C557 2200p 500V
C555 250V 22
FV
VS
D556 MA4360H
R557 10k
R556 3.3k
TPD1
C560 50V 2.2
D555 MA165
C554 500V 560p
D560 MA165
R565 10k
R564 100k
R563 120k
A12
C2
HEATER GND
HEATER
200V
200V
20" model : 200.4Vdc4%
HEATER (6)
20" model : 6.74Vrms2%
TPD9
13V
464mA
D823 RL30A
C816 1kV 820p
C807 50V 3.3
Q804 2SA1767Q
C808 16V 100
R808 1.5
R809 1.5
C809 200V 150
D825 TVSSR2KLV
JS826
130V
T801 ETS25AD129MC
D553 AU02V0
R553 1
C552 25V 220
C553 500V 560p
R551 1.0
D551 RU2M
C556 16V 470
D561 AU02V0
TPD8
R552 1.0
C561 500V 560p
C551 35V 330
AUDIO B+
26V
19V
20" model : 25.90Vdc3%
20" model : 20.18Vdc3%

IMPORTANT SAFETY NOTICE

THIS SCHEMATIC DIAGRAM INCORPORATES SPECIAL FEATURES THAT ARE IMPORTANT FOR PROTECTION FROM X-RADIATION, FIRE AND ELECTRICAL SHOCK HAZARDS. WHEN SERVICING IT IS ESSENTIAL THAT ONLY MANUFACTURERS SPECIFIED PARTS BE USED FOR THE CRITICAL COMPONENTS DESIGNATED WITH A ⚠ IN THE SCHEMATIC.

CHIP TRANSISTOR LEAD DESIGNATION



A
B
C
1
2
3
4
MTC9807/36C1
STANDBY 12V
5V REGULATOR
Q002 2SC1685QRS
Q003 MSB709
Q2309 MSB709
Q304 MSD601
IC551 AN78M09
IC552 AN78M05
IC101 AN5165K
IC2304 LA4285
IC2303 LA4285
A11
TP47R
TP47G
TP47B
TNR001 ENV56D37G3
AUDIO OUT
INT/EXT SW
DC VOL ATT
AUDIO OUTPUT
PREGND
POWGND
VCC
AGC
TU
ADD
SCL
SDA
BM
BPL
NC
BTL
IF1
SP
L2301 TSKA064 EXCELDR25C
S2301 ESB621283
D3006 MA4110N
D3007 MA4110M
D3008 MA4110M
D3016 MA3056M
STAND_BY
AUDIO
FA1
VOL
L-AY1
R-AY1
H SYNC
RESET
RED
GREEN
BLUE
YS
X601 TSS2AA001
X101 M1960M
X501 TAFCSB503F38
X201 EFCS4R5MS5W
X102 EFCS4504AB
J214 EXCELSA247
99mA
30mA

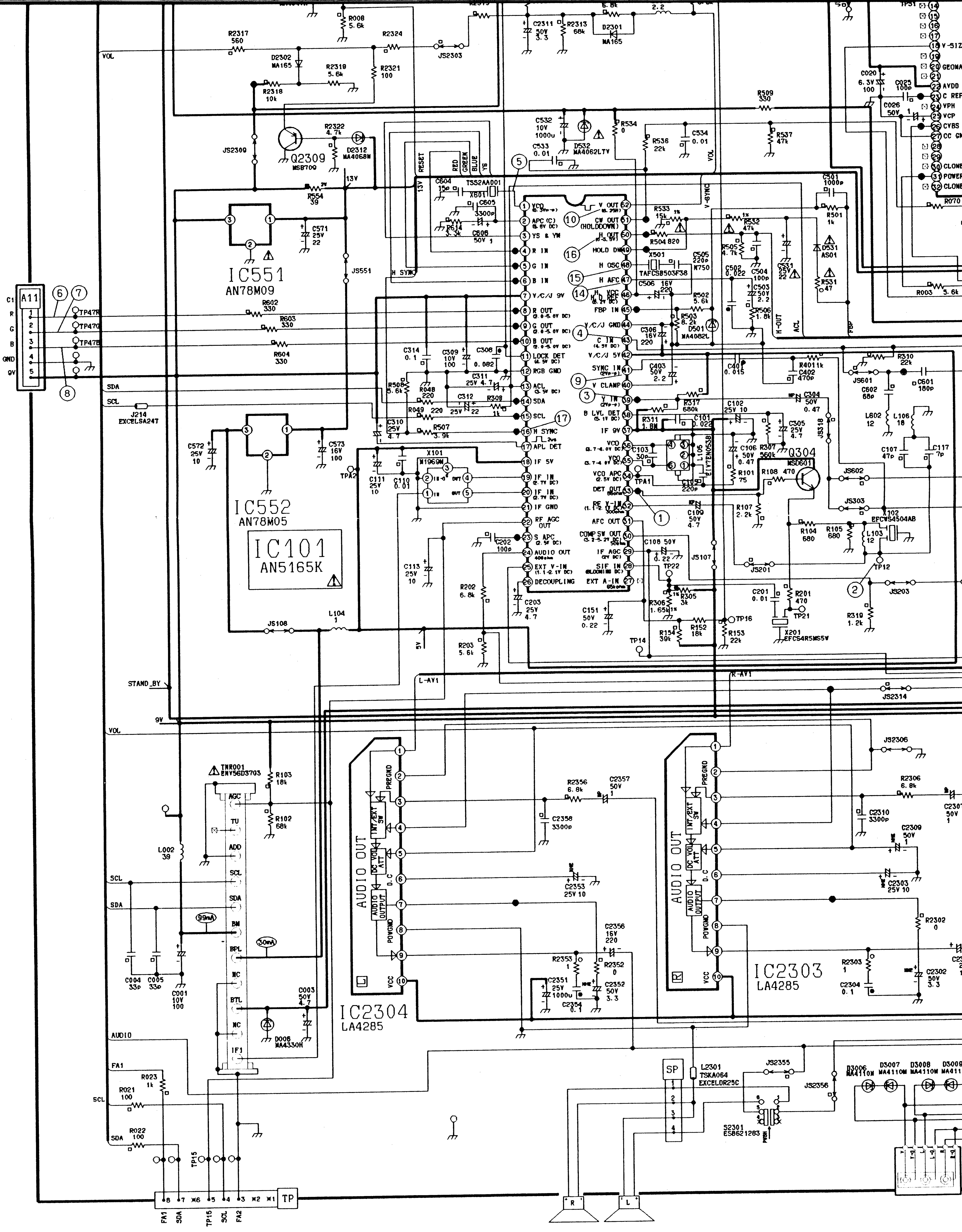
2

3

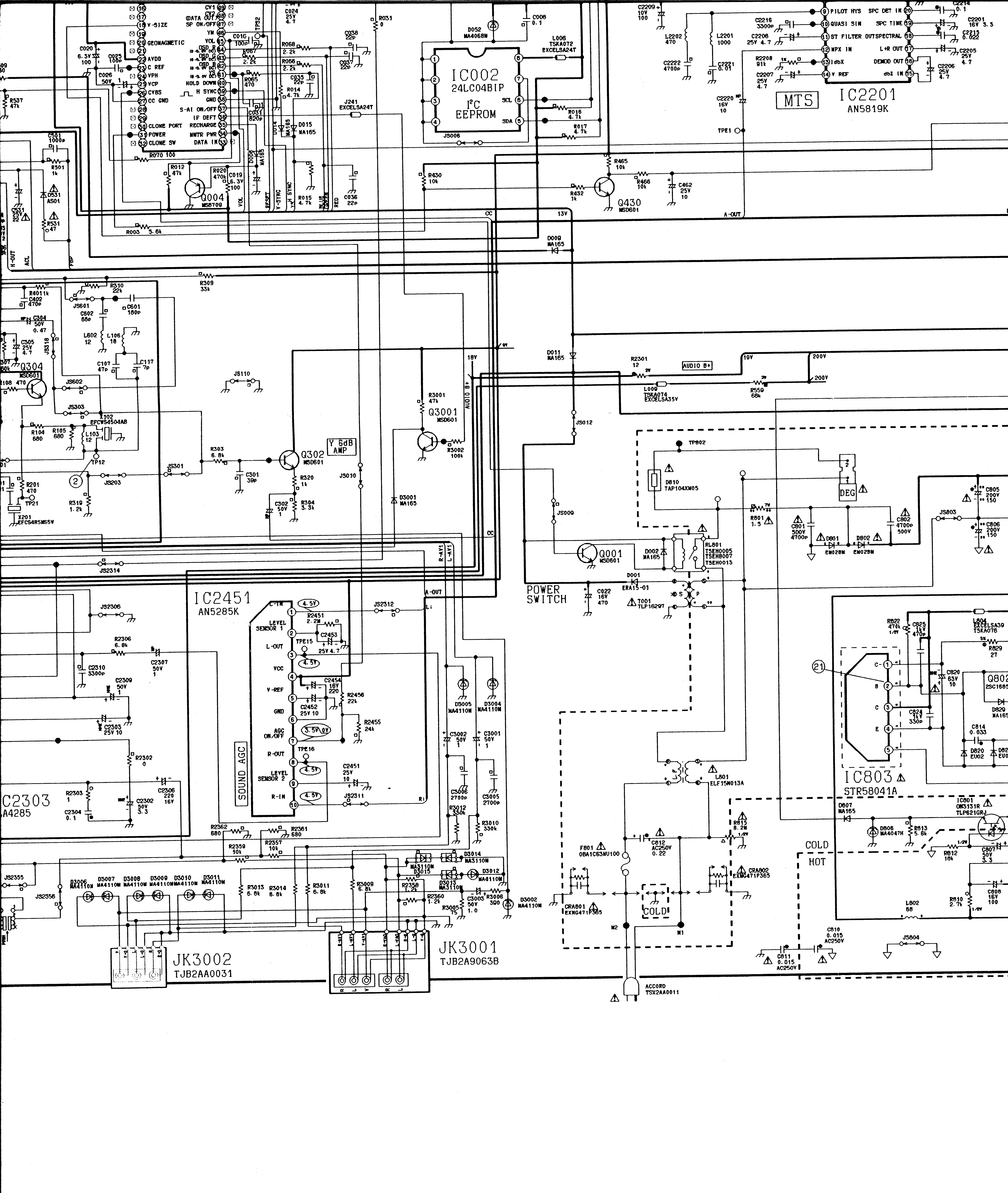
4

5
A2

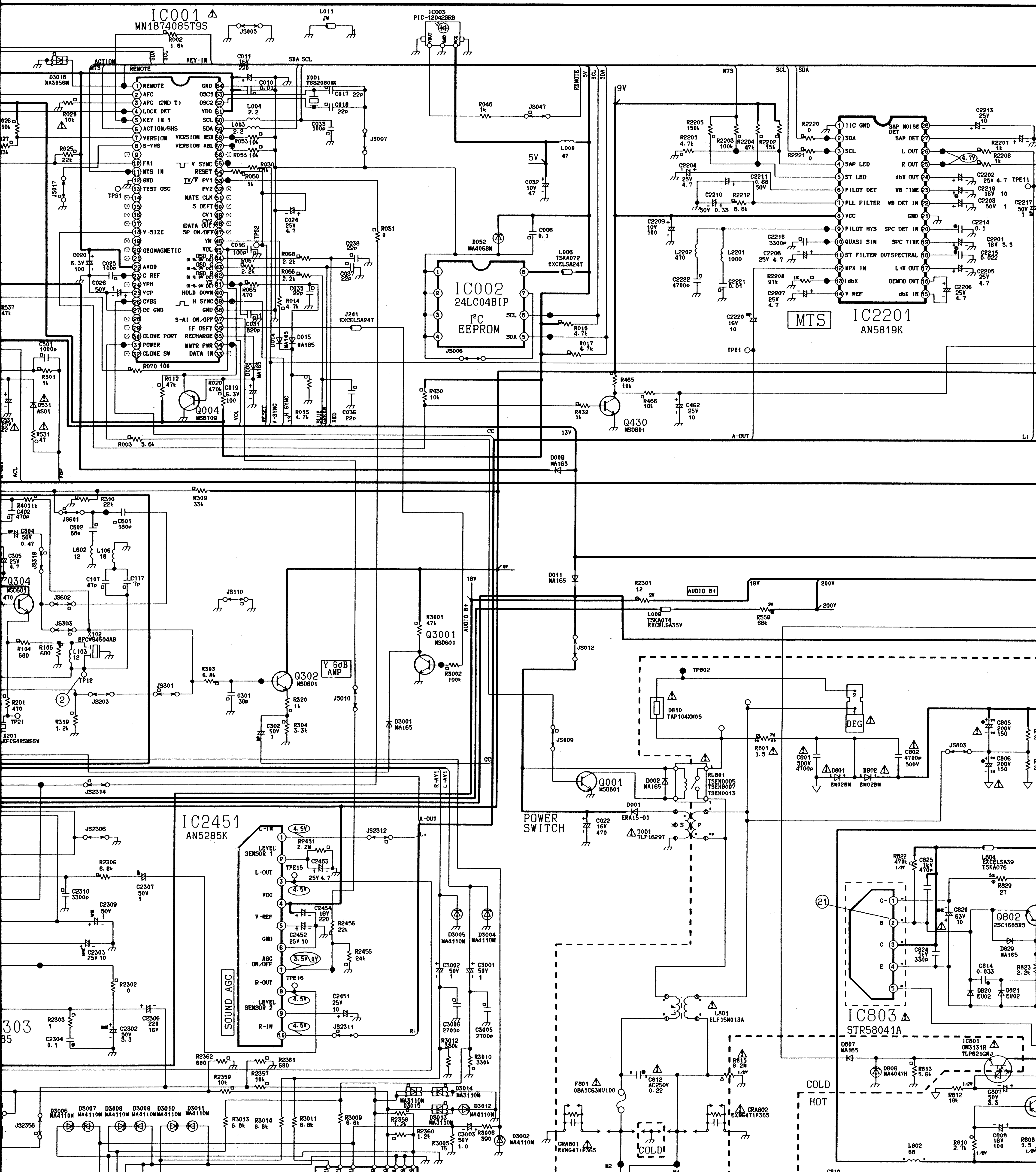
MTC9801/36C1

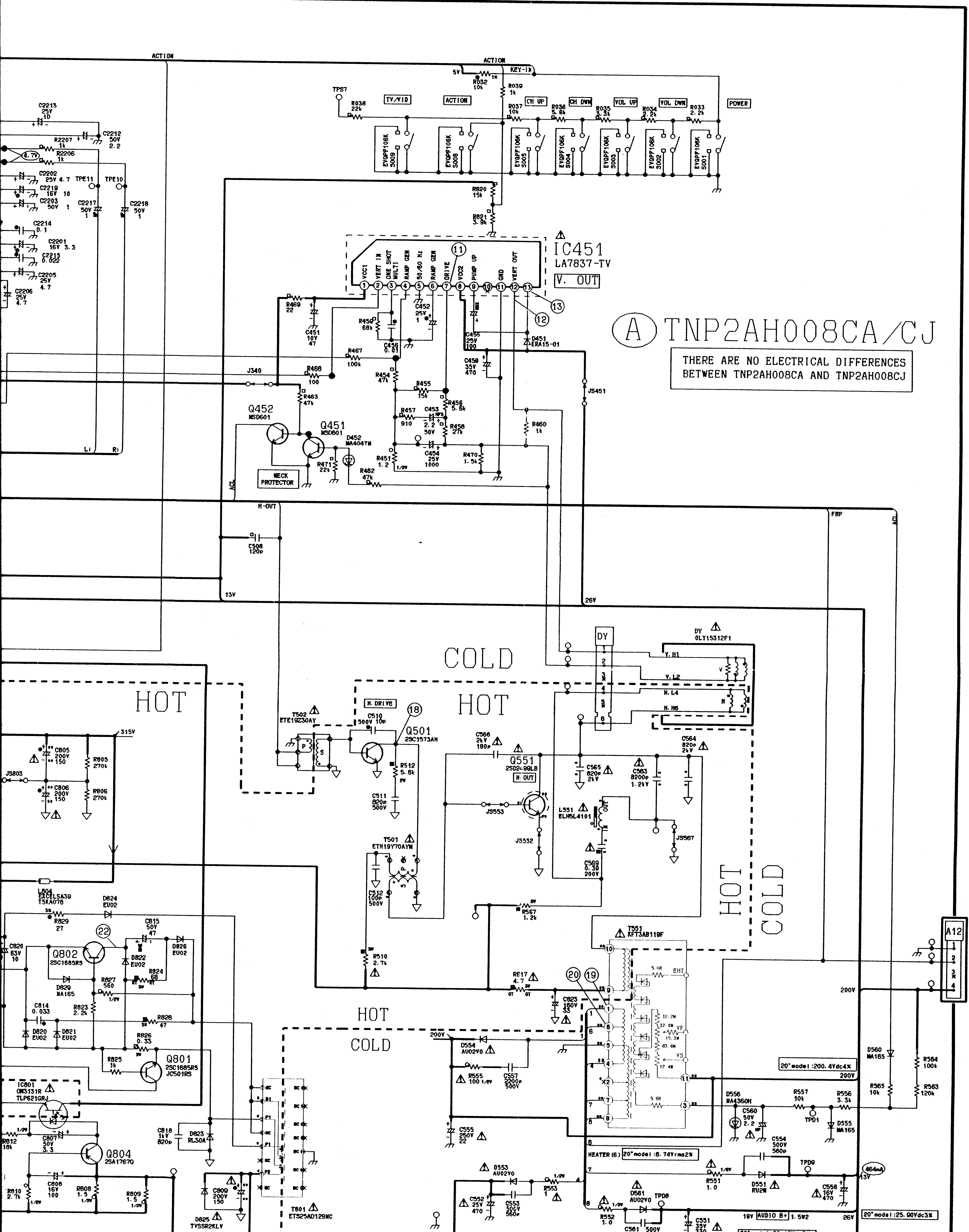


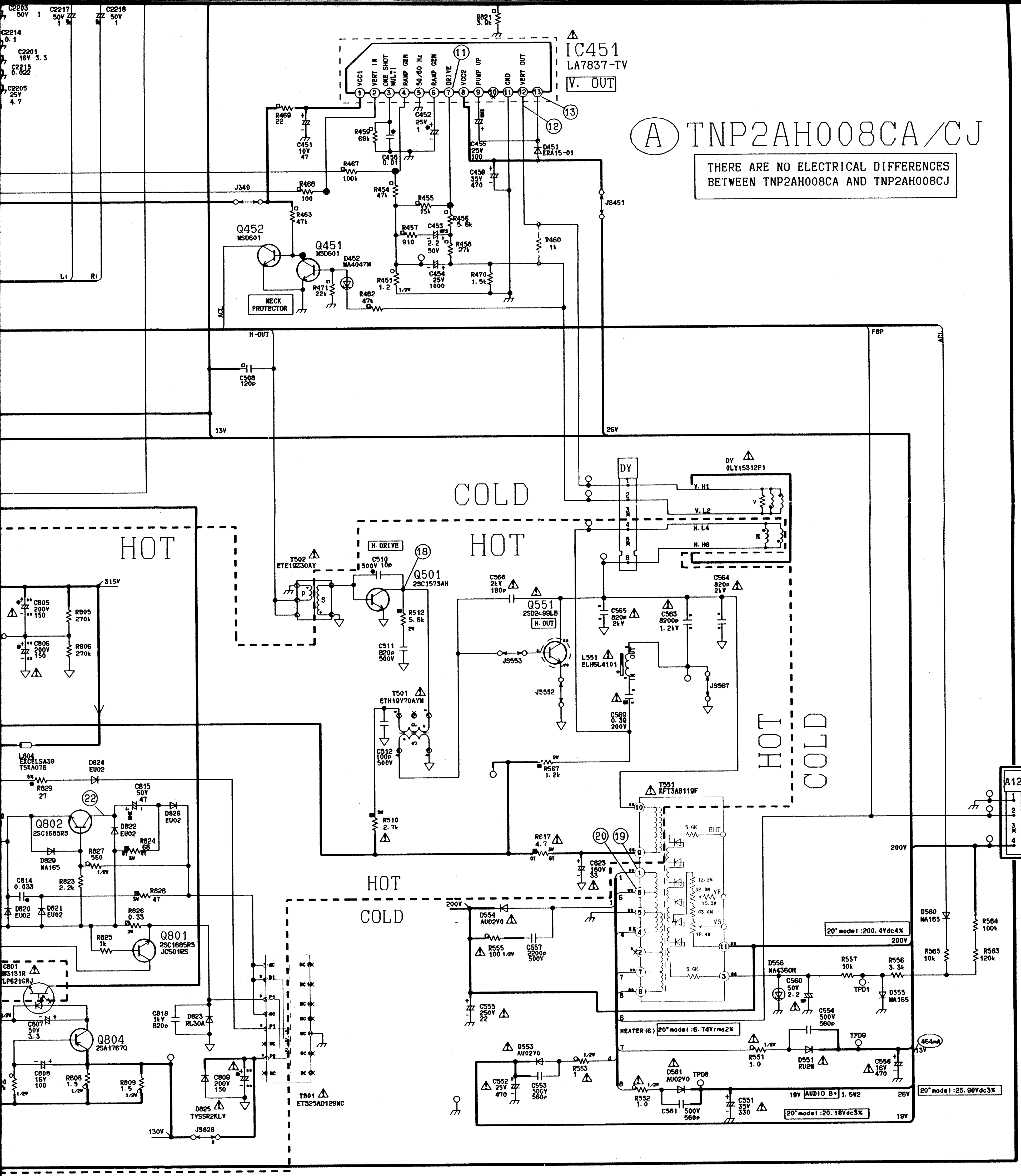
IC551
AN78M09
IC552
AN78M05
IC101
AN5165K
IC2304
LA4285
IC2303
LA4285
AUDIO OUT
INT/EXT SW
DC VOL ATT
AUDIO OUTPUT
PREGND
POWGND
VCC
D.C
Q2309
MSB709
Q304
MSD601
A11
TP47R
TP47G
TP47B
GND
9V
VOL
SDA
SCL
STAND_BY
AUDIO
FA1
J214
EXCELSA247
TNR001
ENV56D3703
AGC
TU
ADD
BM
BPL
NC
BTL
IF1
TP
TP15
FA2
SP
L2301
TSKA064
EXCELDR25C
S2301
ESB621283
X101
M1969M
X501
TAFCSB503F38
X601
TSS2AA001
X201
EFCS4R5MS5W
X102
EFCV54504AB
L-AV1
R-AV1
VCO
APC (C)
YS & YM
R IN
G IN
B IN
Y/C/J 9V
R OUT
G OUT
B OUT
LOCK DET
RGB GND
ACL
SDA
SCL
H SYNC
APL DET
IF 5V
IF IN
IF GND
RF AGC OUT
S APC
AUDIO OUT
EXT V-IN
DECOUPLING
EXT A-IN
SIF IN
IF AGC
COMP SW OUT
AFC OUT
RC V-IN
DET OUT
VCO APC
VCO
IF 9V
B LVL DET
Y IN
V CLAMP
SYNC IN
Y/C/J 5V
C IN
Y/C/J GND
FBP IN
H AFC
H OSC
HOLD DN
H OUT
CW OUT (HOLDDOWN)
V OUT
RESET
RED
GREEN
BLUE
YS
H SYNC
V-SYNC
H-OUT
ACL
FBP
13V
5V
9V
V-SIZ
GEOMA
AVDD
C REF
VPH
VCP
CVBS
CC GN
CLONE
POWER
D3006
MA4110M
D3007
MA4110M
D3008
MA4110M
D3009


IC002
24LC04BIP
I²C EEPROM
SCL
SDA
L006 TSKA072 EXCELSA24T
D052 MA4068N
C008 0.1
R031 0
J241 EXCELSA24T
JS006
MTS
IC2201
AN5819K
PILOT HYS
SPC DET IN
QUASI SIN
SPC TIME
ST FILTER OUTSPECTRAL
MPX IN
L+R OUT
IdbX
DEMOD OUT
V REF
dbI IN
L2202 470
L2201 1000
C2222 4700p
C2221 0.01
C2220 16V 10
TPE1
R2208 91k
C2216 3300p
C2208 25V 4.7
C2207 25V 4.7
C2201 16V 3.3
C2215 0.022
C2205 25V 4.7
C2206 25V 4.7
C2214 0.1
C2209 10V 100
V-SIZE
GEOMAGNETIC
AVDD
C REF
VPH
VCP
CVBS
CC GND
CLONE PORT
POWER
CLONE SW
DATA OUT
SP ON/OFF
VOL
OSD R
OSD G
OSD B
YS
HOLD DOWN
H SYNC
GND
S-AI ON/OFF
IF DEFT
RECHARGE
MNTR PWR
DATA IN
Q004 MSB709
R012 47k
R020 470k
C019 6.3V 100
R070 100
R003 5.6k
Q430 MSD601
R465 10k
R466 10k
R430 10k
R432 1k
C462 25V 10
A-OUT
13V
CC
D009 MA165
D011 MA165
R309 33k
R310 22k
C501 1000p
R501 1k
D531 AS01
R531 47
R537 47k
H-OUT
ACL
FBP
Q304 MSD601
JS601
JS602
JS303
JS318
L602 12
L106 18
C107 47p
C117 7p
C601 180p
C602 68p
C304 50V 0.47
C305 25V 4.7
R104 680
R105 680
L103 12
102 EFCWS4504AB
TP12
TP21
R201 470
R319 1.2k
X201 EFCS4R5MS5W
JS110
JS301
JS203
R303 6.8k
C301 39p
Q302 MSD601
Y 6dB AMP
R320 1k
R304 3.3k
C302 50V 1
JS010
D3001 MA165
Q3001 MSD601
R3001 47k
R3002 100k
AUDIO B+
18V
9V
R2301 12
AUDIO B+
L009 TSKA074 EXCELSA35V
R559 68k
19V
200V
JS012
TP802
D810 TAP104XM05
DEG
JS009
Q001 MSD601
D002 MA165
RL801 TSEH0005 TSEH0007 TSEH0013
POWER SWITCH
C022 16V 470
D001 ERA15-01
T001 TLP16297
R801 1.5
C801 500V 4700p
D801 EM02BM
D802 EM02BM
C802 4700p 500V
JS803
C805 200V 150
C806 200V 150
JS2314
IC2451
AN5285K
SOUND AGC
L-IN
LEVEL SENSOR 1
L-OUT
VCC
V-REF
GND
AGC ON/OFF
R-OUT
LEVEL SENSOR 2
R-IN
4.5V
3.5V 0V
TPE15
TPE16
R2451 2.2M
C2453 25V 4.7
C2454 16V 220
C2452 25V 10
R2456 22k
R2455 24k
C2451 25V 10
JS2312
JS2311
JS2306
R2306 6.8k
C2310 3300p
C2307 50V 1
C2309 50V 1
C2303 25V 10
R2302 0
C2306 220 16V
C2302 50V 3.3
R2303 1
C2304 0.1
IC2303
A4285
R-AV1
L-AV1
D3005 MA4110M
D3004 MA4110M
C3002 50V 1
C3001 50V 1
C3006 2700p
C3005 2700p
R3012 330k
R3010 330k
R2362 680
R2361 680
R2359 10k
R2357 10k
JS2355
JS2356
D3006 MA4110M
D3007 MA4110M
D3008 MA4110M
D3009 MA4110M
D3010 MA4110M
D3011 MA4110M
R3013 6.8k
R3014 6.8k
R3011 6.8k
R3009 6.8k
R2358 1.2k
R2360 1.2k
D3015
D3014 MA3110M
D3013 MA3110M
D3012 MA4110M
C3003 50V 1.0
R3006 390
R3005 75
D3002 MA4110M
JK3002
TJB2AA0031
JK3001
TJB2A9063B
L801 ELF15N013A
R815 8.2M
F801 0BA1C63NU100
C812 AC250V 0.22
CRA801 EXNG471P365
CRA802 EXNG471P365
COLD
M2
M1
ACCORD TSX2AA0011
COLD
HOT
IC803
STR58041A
R822 470k
C825 1kV 470p
L804 EXCELSA39 TSKA076
R829 27
C820 63V 10
Q802 2SC1685
D829 MA165
C824 1kV 330p
C814 0.033
D820 EU02
D807 MA165
IC801 ON3131R TLP621GRJ
D806 MA4047H
R613 5.6k
R812 18k
C807 50V 3.3
C808 16V 100
R810 2.7k
L802 68
C810 0.015 AC250V
C811 0.015 AC250V
JS804
21
2

A–Board Schematic
CT–20G23W & CT–20G23DW


IC001 ⚠
MN1874085T9S
REMOTE
AFC
AFC (2ND T)
LOCK DET
KEY IN 1
ACTION/HHS
VERSION
S-VHS
FA1
MTS IN
GND
TEST OSC
V-SIZE
GEOMAGNETIC
AVDD
C REF
VPH
VCP
CVBS
CC GND
CLONE PORT
POWER
CLONE SW
GND
OSC1
OSC2
VDD
SCL
SDA
VERSION MSB
VERSION ABL
V SYNC
RESET
TV/V PV1
PV2
MATE CLK
S DEFT
CV1
DATA OUT
SP ON/OFF
YM
VOL
OSD R
OSD G
OSD B
YS
HOLD DOWN
H SYNC
S-AI ON/OFF
IF DEFT
RECHARGE
MNTR PWR
DATA IN
X001
TSS2080MX
IC003
PIC-12042SRB
L011
JW
IC002
24LC04BIP
I²C
EEPROM
SCL
SDA
Q004
MSB709
Q430
MSD601
D052
MA4068M
L006
TSKA072
EXCELSA24T
J241
EXCELSA24T
D009
MA165
13V
CC
A-OUT
9V
5V
MTS
SCL
SDA
IC2201
AN5819K
IIC GND
SAP LED
ST LED
PILOT DET
PLL FILTER
VCC
PILOT HYS
QUASI SIN
ST FILTER
MPX IN
I dbX
V REF
SAP NOISE DET
SAP DET
L OUT
R OUT
dbX OUT
WB TIME
WB DET IN
GND
SPC DET IN
SPC TIME
OUTSPECTRAL
L+R OUT
DEMOD OUT
dbl IN
TPE1
TPE11
Q304
MSD601
Q302
MSD601
Y 6dB AMP
Q3001
MSD601
AUDIO B+
18V
9V
D011
MA165
R2301
12
L009
TSKA074
EXCELSA35V
R559
68k
19V
200V
D3001
MA165
JS012
JS009
TP802
D810
TAP104XM05
DEG ⚠
R801 1.5 ⚠
C801 500V 4700p
D801 EM02BM
D802 EM02BM
C802 4700p 500V
JS803
C805 200V 150
C806 200V 150
Q001
MSD601
D002
MA165
RL801
TSEH0005
TSEH0007
TSEH0013
D001
ERA15-01
POWER SWITCH
C022 16V 470
T001
TLP16297
S P
L801
ELF15N013A
R815 8.2M
C812 AC250V 0.22
F801 ⚠ 0BA1C63MU100
CRA801 EXNG471P365
CRA802 EXNG471P365
COLD
HOT
IC2451
AN5285K
LEVEL SENSOR 1
L-OUT
VCC
V-REF
GND
AGC ON/OFF
R-OUT
LEVEL SENSOR 2
R-IN
L-IN
SOUND AGC
4.5V
3.5V 0V
TPE15
TPE16
JS2312
JS2311
D3005 MA4110M
D3004 MA4110M
D3006 MA4110M
D3007 MA4110M
D3008 MA4110M
D3009 MA4110M
D3010 MA4110M
D3011 MA4110M
D3012 MA4110M
D3013 MA3110M
D3014 MA3110M
D3015 MA3110M
D3002 MA4110M
IC803 ⚠
STR58041A
Q802
2SC1685RS
L804
EXCELSA39
TSKA076
R822 470k
C825 1kV 470p
C820 63V 10
C824 1kV 330p
C814 0.033
D829 MA165
D820 EU02
D821 EU02
D807 MA165
D806 MA4047H
R813 5.6k
IC801 ON3131R TLP621GRJ
R812 18k
C807 50V 3.3
R810 2.7k
L802 68
C808 16V 100
Q303
21
2
TP12
TP21
X201
EFCS4R5MS5W
L102
EFCW54504AB
TPS1
JS2314
JS2306
JS2356


A TNP2AH008CA/CJ
THERE ARE NO ELECTRICAL DIFFERENCES BETWEEN TNP2AH008CA AND TNP2AH008CJ
IC451
LA7837-TV
V. OUT
VCC1
VERT IN
ONE SHOT MULTI
RAMP GEN
50/60 Hz
RAMP GEN
DRIVE
VCC2
PUMP UP
GND
VERT OUT
ACTION
KEY-IN
TPS7
TV/VID
ACTION
CH UP
CH DWN
VOL UP
VOL DWN
POWER
EVQPF106K S009
EVQPF106K S008
EVQPF106K S005
EVQPF106K S004
EVQPF106K S003
EVQPF106K S002
EVQPF106K S001
Q452 MSD601
Q451 MSD601
D452 MA4047M
NECK PROTECTOR
J340
JS451
H-OUT
C508 120p
FBP
ACL
13V
26V
DY
DY 0LY15312F1
V.H1
V.L2
H.L4
H.H6
COLD
HOT
H. DRIVE
T502 ETE19Z30AY
Q501 2SC1573AH
C510 500V 10p
Q551 2SD2499LB
H.OUT
L551 ELH5L4101
T501 ETH19Y70AYM
C566 2kV 180p
C565 820p 2kV
C563 8200p 1.2kV
C564 820p 2kV
C569 0.39 200V
JS553
JS552
JS567
T551 KFT3AB119F
EHT
VF
VS
HEATER (6)
20"model:6.74Vrms2%
20"model:200.4Vdc4%
20"model:25.90Vdc3%
A12
HEATER GND
HEATER
200V
315V
JS803
Q802 2SC1685RS
Q801 2SC1685RS JC501RS
Q804 2SA1767Q
IC801 ON3131R TLP621GRJ
L804 EXCELSA39 T5KA076
D823 RL30A
T801 ETS25AD129NC
D825 TVSSR2KLY
D554 AU02V0
D553 AU02V0
D581 AU02V0
D551 RU2M
D556 MA4360H
D555 MA165
D560 MA165
TPD1
TPD8
TPD9
464mA
19V
AUDIO B+
1.5W2
26V


IC451
LA7837-TV
V. OUT
VCC1
VERT IN
ONE SHOT MULTI
RAMP GEN
50/60 Hz
RAMP GEN
DRIVE
VCC2
PUMP UP
GND
VERT OUT
Q452
MSD601
Q451
MSD601
D452
MA4047M
NECK PROTECTOR
D451
ERA15-01
J340
JS451
H-OUT
FBP
C508
120p
13V
26V
COLD
HOT
T502
ETE19Z30AY
H. DRIVE
Q501
2SC1573AH
R512
5.6k
C511
820p
500V
T501
ETH19Y70AYM
C512
100p
500V
R510
2.7k
C566
2kV
180p
Q551
2SD2499LB
H. OUT
JS553
JS552
L551
ELH5L4101
C565
820p
2kV
C563
8200p
1.2kV
C564
820p
2kV
JS567
C569
0.39
200V
R567
1.2k
DY
0LY15312F1
V.H1
V.L2
H.L4
H.H6
T551
XFT3AB119F
R617
4.7
C823
160V
33
EHT
VF
VS
200V
D554
AU02V0
R555
100
C557
2200p
500V
C555
250V
22
D553
AU02V0
C552
25V
470
C553
500V
560p
R553
1
HEATER (6)
20"model:6.74Vrms2%
R552
1.0
D561
AU02V0
TPD8
C561
500V
560p
C551
35V
330
19V
AUDIO B+
1.5W2
20"model:20.18Vdc3%
19V
26V
20"model:25.90Vdc3%
R551
1.0
D551
RU2M
C556
16V
470
TPD9
464mA
13V
C554
500V
560p
D556
MA4360H
C560
50V
2.2
R557
10k
TPD1
R556
3.3k
D555
MA165
20"model:200.4Vdc4%
200V
D560
MA165
R564
100k
R565
10k
R563
120k
A12
C2
HEATER GND
HEATER
200V
200V
315V
C805
200V
150
R805
270k
C806
200V
150
R806
270k
L804
EXCELSA39
TSKA076
D824
EU02
R829
27
C815
50V
47
D826
EU02
Q802
2SC1685RS
D822
EU02
R824
68
R827
560
D829
MA165
R823
2.2k
C814
0.033
R828
47
D820
EU02
D821
EU02
R826
0.33
R825
1k
Q801
2SC1685RS
JC501RS
C801
LP621GRJ
C807
50V
3.3
Q804
2SA1767Q
C808
16V
100
R808
1.5
R809
1.5
C818
1kV
820p
D823
RL30A
C809
200V
150
D825
TVSSR2KLV
130V
JS828
T801
ET325AD129NC

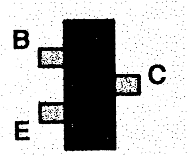
Ⓐ TNP2AH008CA/CJ

THERE ARE NO ELECTRICAL DIFFERENCES
BETWEEN TNP2AH008CA AND TNP2AH008CJ

IMPORTANT SAFETY NOTICE

THIS SCHEMATIC DIAGRAM INCORPORATES SPECIAL FEATURES THAT ARE IMPORTANT FOR PROTECTION FROM X-RADIATION, FIRE AND ELECTRICAL SHOCK HAZARDS. WHEN SERVICING IT IS ESSENTIAL THAT ONLY MANUFACTURERS SPECIFIED PARTS BE USED FOR THE CRITICAL COMPONENTS DESIGNATED WITH A ⚠ IN THE SCHEMATIC.

CHIP TRANSISTOR LEAD DESIGNATION

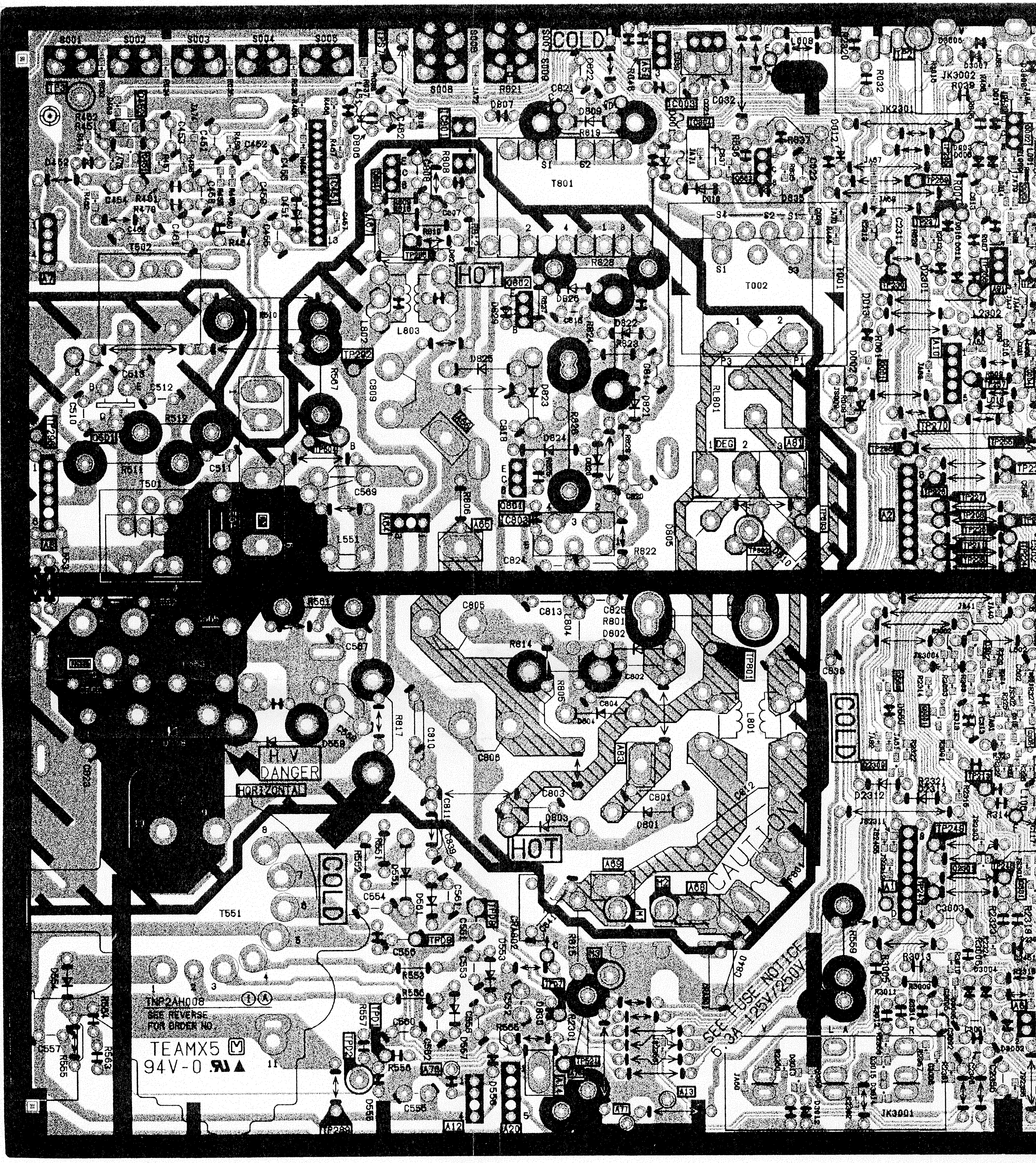


A B C

1

A–Board Layout

2


COLD
HOT
T801
T002
RL801
DEG
T501
T551
L803
L801
H.V
DANGER
HORIZONTAL
COLD
HOT
CAUTION
SEE USE NOTICE
6.3A 125V/250V
TNP2AH008
SEE REVERSE
FOR ORDER NO.
TEAMX5
94V-0
JK3001
JK3002
JK2301

3

4

MTC9801736C1

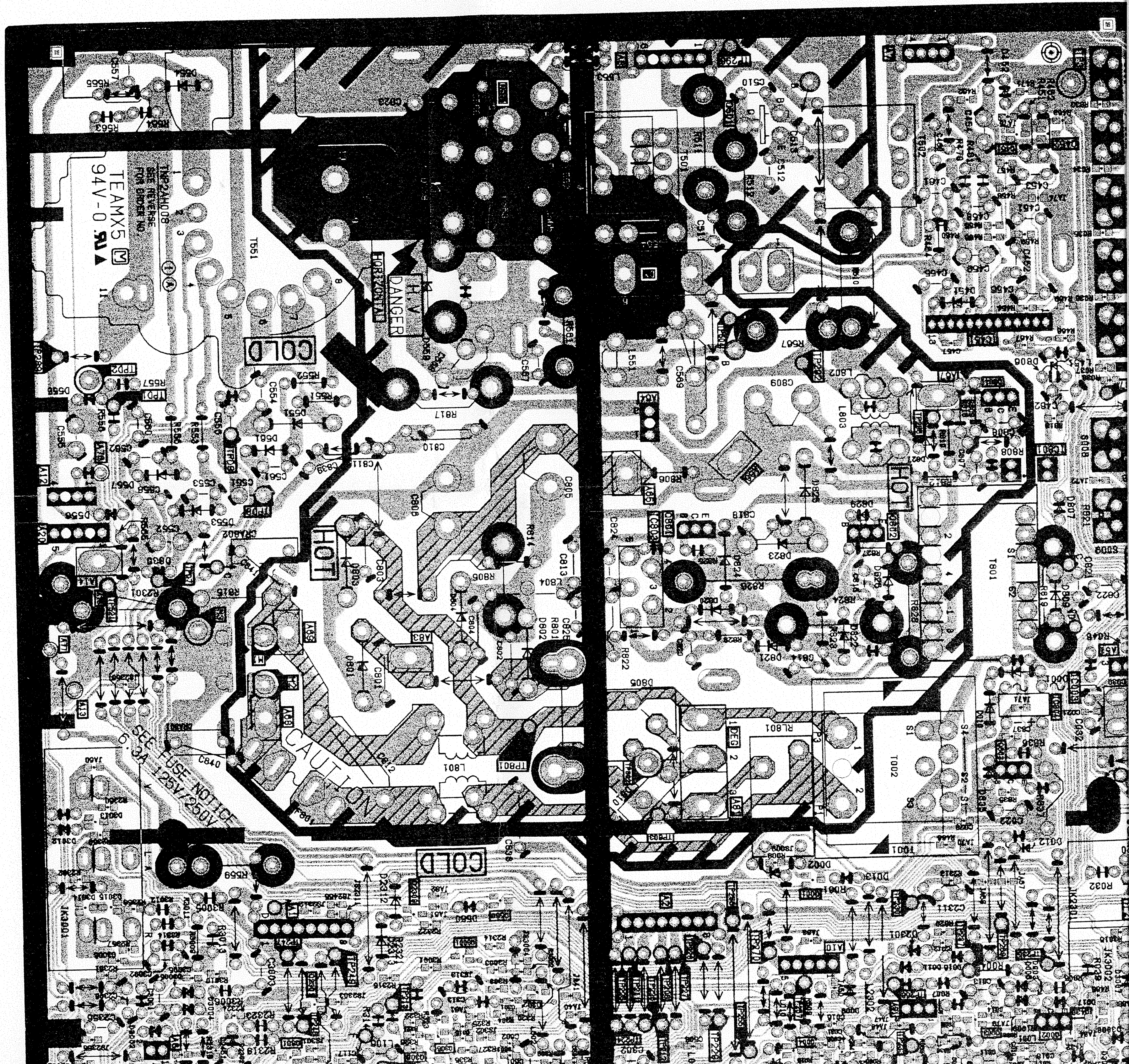
Sheet 3 of 3
Side A

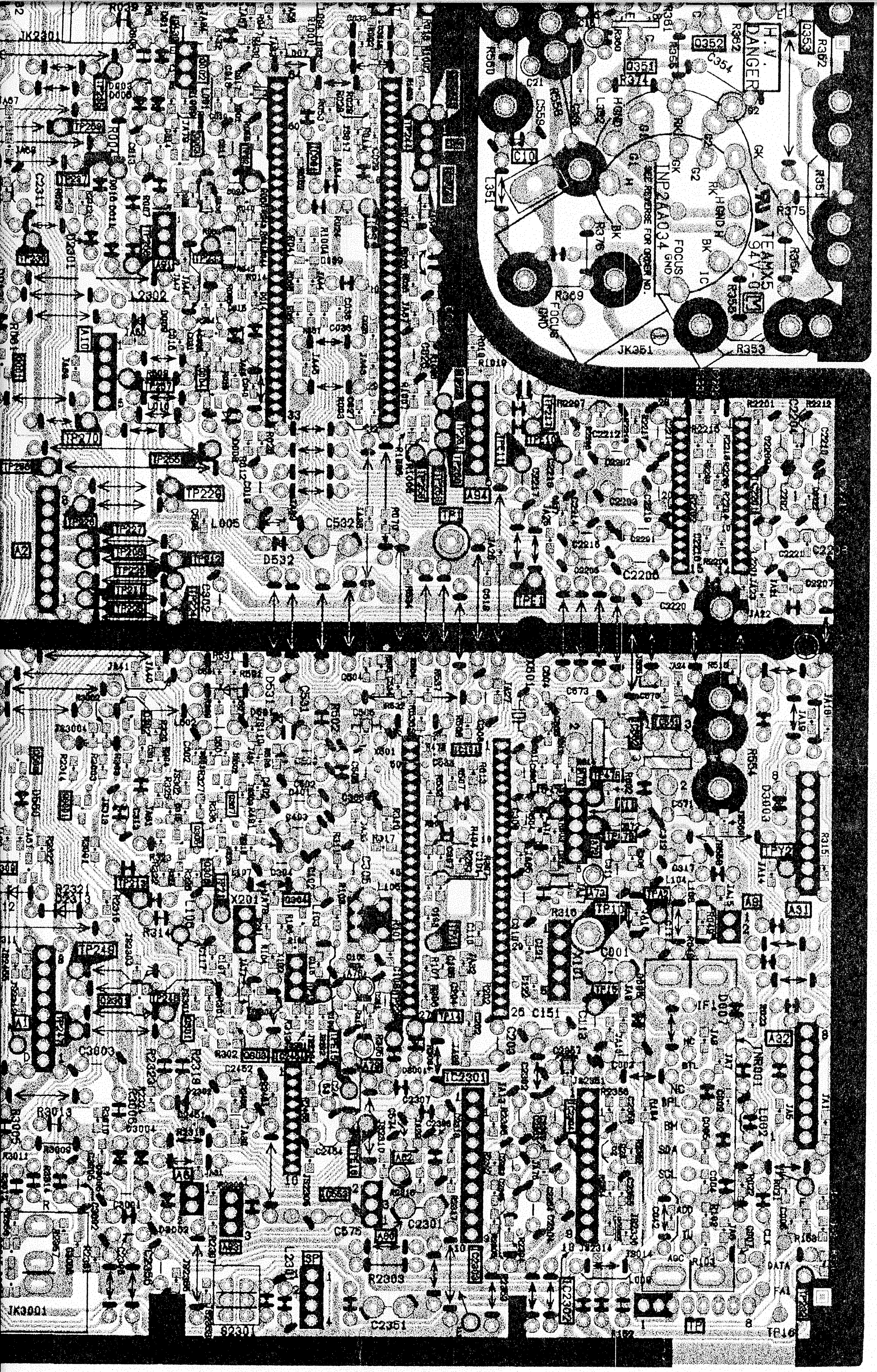
A & C Board Layouts
C–Board Voltages
All Models

Sheet 3 of 3
Side A

MTC9801736C1

5 A3 | 4 | 3 | 2


HOT
COLD
H.V DANGER
HORIZONTAL
CAUTION
SEE FUSE NOTICE
6.3A 125V/250V
TNP2AH008
SEE REVERSE
FOR ORDER NO.
TEAMX5
94V-0
T551
T501
T502
T801
T002
T001
L801
L803
L551
RL801
DEG
R817
R814
R805
R567
R559
C809
C810
C811
C805
C806
C840
C569
C567
D801
D802
D803
TP801
JK3001
JK3002



signals from the MPU.

NOTE: Voltage at the BTL pin of the tuner varies with chann selection. Refer to chart for sample tuning voltages TV/CATV(CABLE) channels as shown.

Voltage Reading Are Nominal And May Vary ± 15%

- VHF -	
Ch. 02	4.0V
Ch. 06	8.2V
Ch. 07	7.0V
Ch. 13	9.3V

- UHF -	
Ch. 14	7.7V
Ch. 69	24V

- CABLE -					
1st Band		2nd Band		3rd Band	
Ch. 1	6.7V	Ch. 16	4.5V	Ch. 47	3.7V
Ch. 15	24.7V	Ch. 46	2.70V	Ch. 94	14.9V
Ch. 95	9.8V			Ch. 100	15.1V
Ch. 99	17.5V			Ch. 125	24.0V

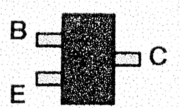
MICROPROCESSOR PROGRAMMING FOR BAND TUNING/SWITCHING

54MHz ◄──► 130MHz ◄──► 360MHz ◄──► 806

	FIRST TUNING BAND	SECOND TUNING BAND	THIRD TUNING BAND
VHF	02~06	07~13	
UHF			14~69
CABLE	01~06,14,15, 95~99	07~13, 16~46	47~94, 100~125

NOTE: CABLE channel numbers as recommended by the joi EIA/NCTA Engineering Committee and published a EIA INTERIM STANDARD NO. 6 - CABL TELEVISION CHANNEL IDENTIFICATION PLAN MAY 1983.

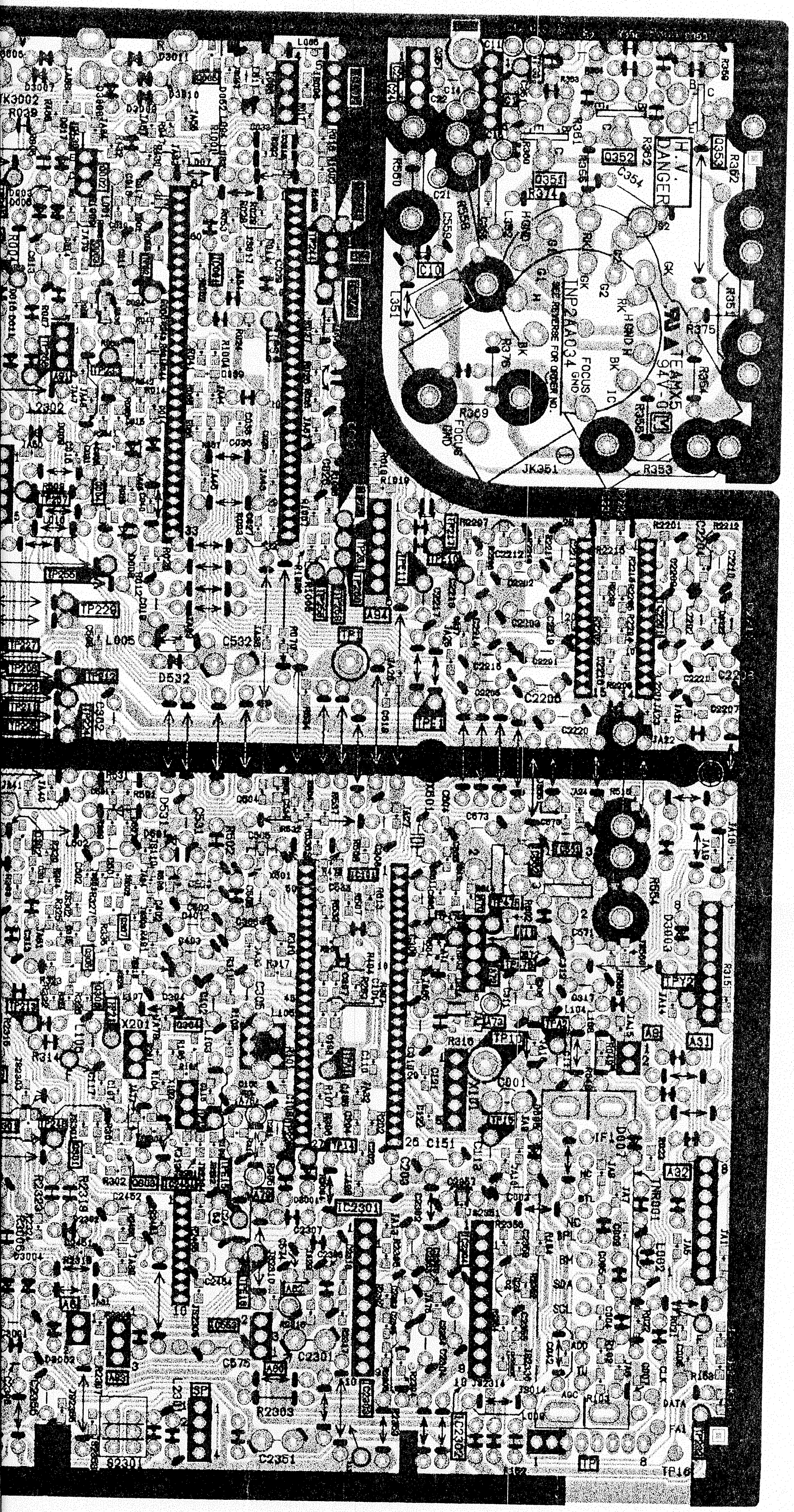
CHIP TRANSISTOR LEAD DESIGNATION



IMPORTANT SAFETY NC

THIS SCHEMATIC DIAGRAM INCORPORAT FEATURES THAT ARE IMPORTANT FOR PROT X-RADIATION, FIRE AND ELECTRICAL SHOCK HA SERVICING IT IS ESSENTIAL THAT ONLY MA SPECIFIED PARTS BE USED FOR THE CRITICAL DESIGNATED WITH A ⚠ IN THE SCHEMATIC.

C–Board Layout



Tuner Voltage Chart

Enable, Data, and Clock have no DC readings. They are digital signals from the MPU.

NOTE: Voltage at the BTL pin of the tuner varies with channel selection. Refer to chart for sample tuning voltages of TV/CATV(CABLE) channels as shown.

Voltage Reading Are Nominal And May Vary ± 15%

- VHF -	
Ch. 02	4.0V
Ch. 06	8.2V
Ch. 07	7.0V
Ch. 13	9.3V

- UHF -	
Ch. 14	7.7V
Ch. 69	24V

- CABLE -					
1st Band		2nd Band		3rd Band	
Ch. 1	6.7V	Ch. 16	4.5V	Ch. 47	3.7V
Ch. 15	24.7V	Ch. 46	2.70V	Ch. 94	14.9V
Ch. 95	9.8V			Ch. 100	15.1V
Ch. 99	17.5V			Ch. 125	24.0V

MICROPROCESSOR PROGRAMMING FOR BAND TUNING/SWITCHING

54MHz ◄──► 130MHz ◄──► 360MHz ◄──► 806MHz

	FIRST TUNING BAND	SECOND TUNING BAND	THIRD TUNING BAND
VHF	02~06	07~13	
UHF			14~69
CABLE	01~06,14,15, 95~99	07~13, 16~46	47~94, 100~125

NOTE: CABLE channel numbers as recommended by the joint EIA/NCTA Engineering Committee and published as EIA INTERIM STANDARD NO. 6 – CABLE TELEVISION CHANNEL IDENTIFICATION PLAN – MAY 1983.

ner Voltage Chart

and Clock have no DC readings. They are digital e MPU.

at the BTL pin of the tuner varies with channel Refer to chart for sample tuning voltages of TV(CABLE) channels as shown.

ding Are Nominal And May Vary ± 15%

-
4.0V
8.2V
7.0V
9.3V

- UHF -	
Ch. 14	7.7V
Ch. 69	24V

- CABLE -				
	2nd Band		3rd Band	
V	Ch. 16	4.5V	Ch. 47	3.7V
.7V	Ch. 46	2.70V	Ch. 94	14.9V
V			Ch. 100	15.1V
.5V			Ch. 125	24.0V

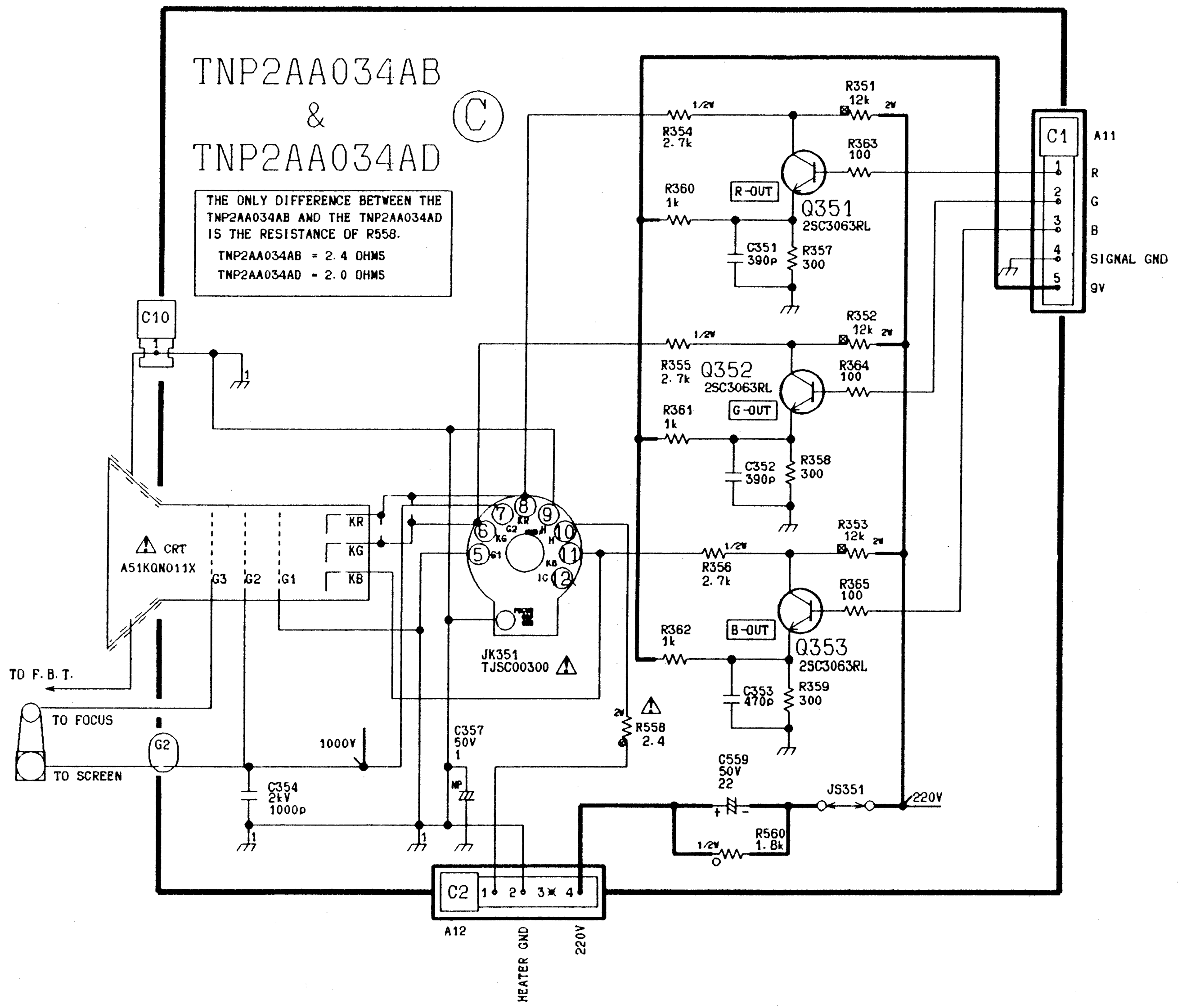
CESSOR PROGRAMMING FOR BAND TUNING/SWITCHING

z ◄──► 130MHz ◄──► 360MHz ◄──► 806MHz

FIRST TUNING BAND	SECOND TUNING BAND	THIRD TUNING BAND
02~06	07~13	
		14~69
01~06,14,15, 95~99	07~13, 16~46	47~94, 100~125

channel numbers as recommended by the joint CTA Engineering Committee and published as INTERIM STANDARD NO. 6 - CABLE VISION CHANNEL IDENTIFICATION PLAN - 1983.

C–Board


TNP2AA034AB
&
TNP2AA034AD
C
THE ONLY DIFFERENCE BETWEEN THE TNP2AA034AB AND THE TNP2AA034AD IS THE RESISTANCE OF R558.
TNP2AA034AB = 2.4 OHMS
TNP2AA034AD = 2.0 OHMS
C10
CRT
A51KQN011X
G3
G2
G1
KR
KG
KB
TO F.B.T.
TO FOCUS
TO SCREEN
G2
1000V
C354
2kV
1000p
JK351
TJSC00300
C357
50V
1
NP
R558
2.4
2W
C2
A12
1
2
3
4
HEATER GND
220V
R351
12k
2W
R354
2.7k
1/2W
R363
100
R360
1k
R-OUT
Q351
2SC3063RL
C351
390p
R357
300
R352
12k
R355
2.7k
Q352
2SC3063RL
R364
100
R361
1k
G-OUT
C352
390p
R358
300
R353
12k
R356
2.7k
R365
100
R362
1k
B-OUT
Q353
2SC3063RL
C353
470p
R359
300
C559
50V
22
R560
1.8k
JS351
220V
C1
A11
R
G
B
SIGNAL GND
9V

Voltage Measurements “C”-Board

Q351	Q352	Q353
3.19	3.25	3.25
147.10	143.00	145.00
2.95	3.00	2.98

in of the tuner varies with channel
rt for sample tuning voltages of
hannels as shown.

ominal And May Vary ± 15%

- UHF -	
Ch. 14	7.7V
Ch. 69	24V

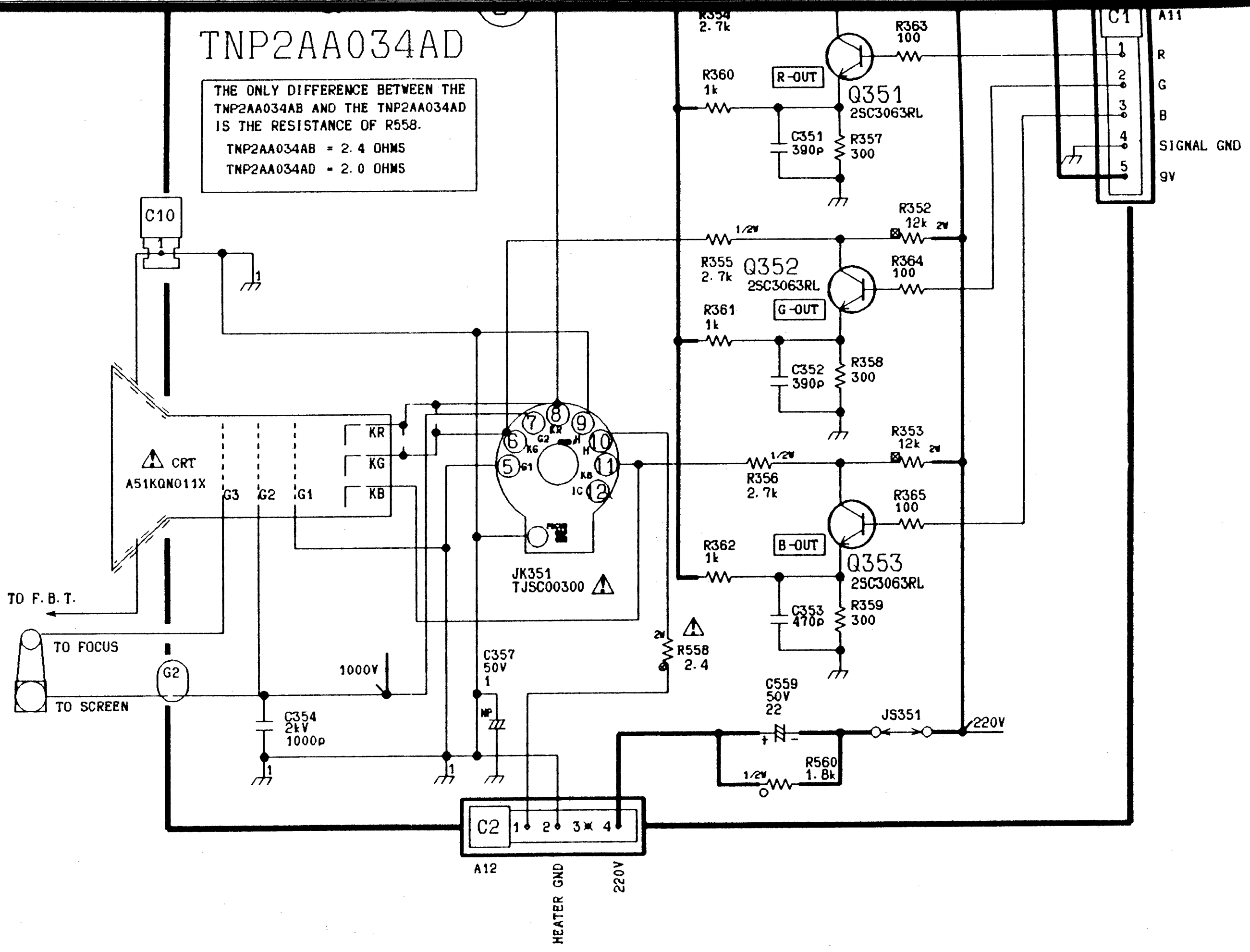
BLE -			
d Band		3rd Band	
6	4.5V	Ch. 47	3.7V
6	2.70V	Ch. 94	14.9V
		Ch. 100	15.1V
		Ch. 125	24.0V

PROGRAMMING FOR BAND /SWITCHING

MHz ◄──► 360MHz ◄──► 806MHz

SECOND TUNING BAND	THIRD TUNING BAND
07~13	
	14~69
07~13, 16~46	47~94, 100~125

nbers as recommended by the joint
ering Committee and published as
STANDARD NO. 6 - CABLE
ANNEL IDENTIFICATION PLAN -


TNP2AA034AD

THE ONLY DIFFERENCE BETWEEN THE TNP2AA034AB AND THE TNP2AA034AD IS THE RESISTANCE OF R558.
TNP2AA034AB = 2.4 OHMS
TNP2AA034AD = 2.0 OHMS

C10
CRT
A51KQN011X
G3
G2
G1
KR
KG
KB
TO F.B.T.
TO FOCUS
TO SCREEN
G2
C354
2kV
1000p
1000V
JK351
TJSC00300
C357
50V
1
R558
2.4
C559
50V
22
R560
1.8k
JS351
220V
C2
A12
HEATER GND
220V
R354
2.7k
R360
1k
R-OUT
Q351
2SC3063RL
R363
100
C351
390p
R357
300
R352
12k
R355
2.7k
Q352
2SC3063RL
R364
100
R361
1k
G-OUT
C352
390p
R358
300
R353
12k
R356
2.7k
R365
100
R362
1k
B-OUT
Q353
2SC3063RL
C353
470p
R359
300
C1
A11
R
G
B
SIGNAL GND
9V

Voltage Measurements “C”-Board

Q351	Q352	Q353
3.19	3.25	3.25
147.10	143.00	145.00
2.95	3.00	2.98

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